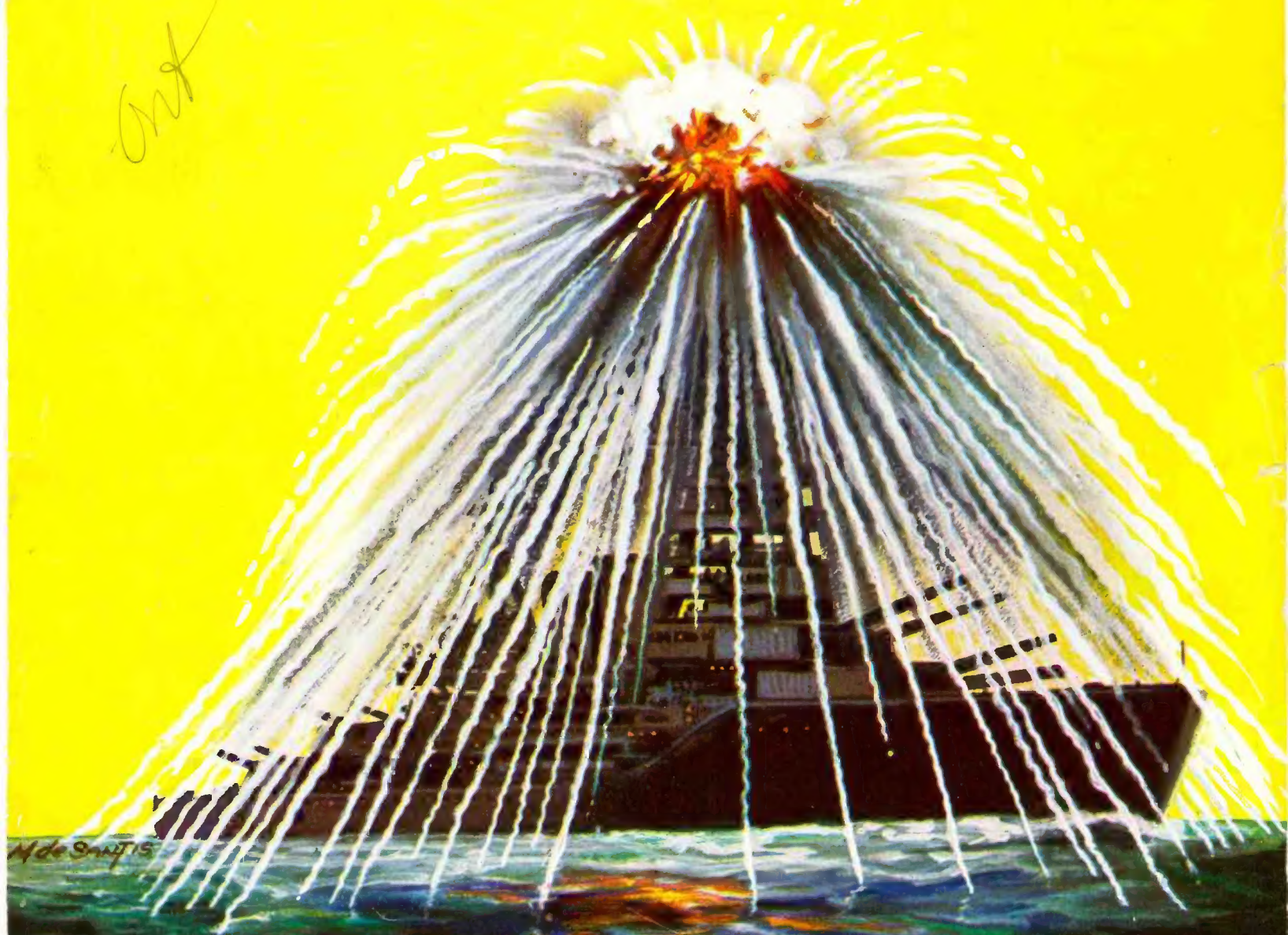
Science and Invention

1931

JUNE

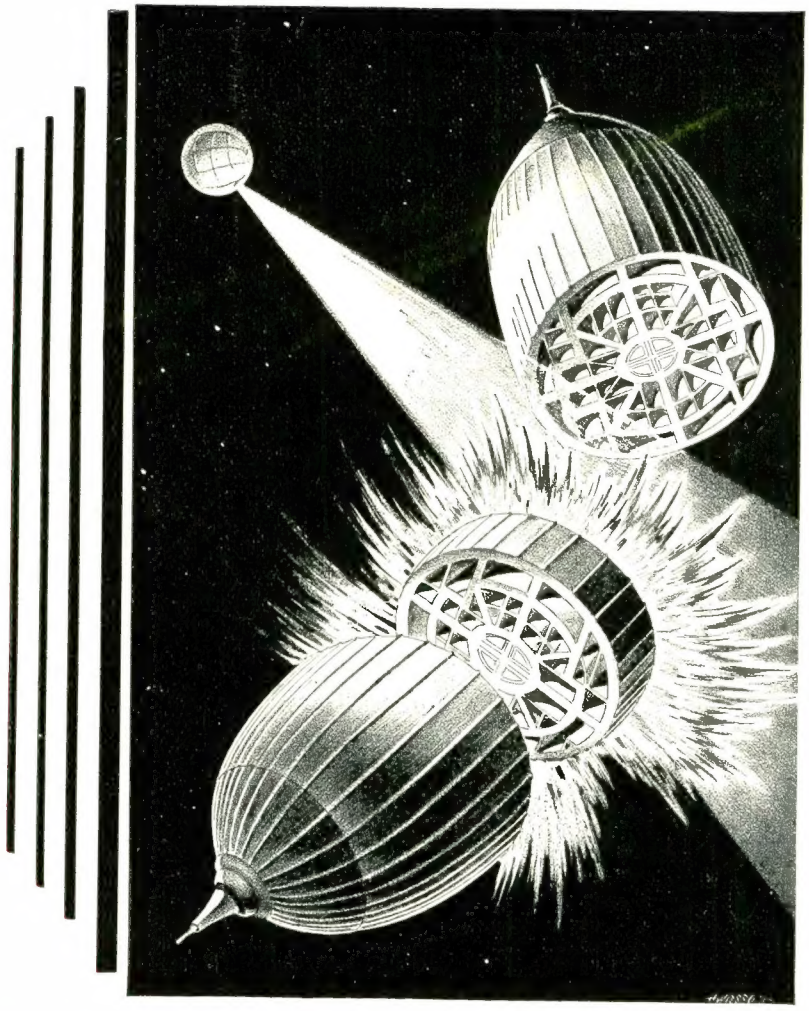
25 Cents



Aerial Bombs Will Decide the Next War

Harnessing the Tides — Forests of Stone

Sliced by Infra-red and Ultra-Violet Rays!



"Stevens made out a relatively tiny ball of metal . . . at a distance of perhaps a mile. From this ball there shot a blinding plane of light,—and the Arcturus fell apart."

MAJESTICALLY, smoothly, powerfully, the gigantic interplanetary vessel *Arcturus* leaves her dock on the earth for her regular trip to Mars. Built of the staunchest metal, protected by deadly projector rays, the *Arcturus* has no need to fear the cosmic bodies hurling through space to challenge her way! She can pass through treacherous meteoric swarms with ease.

Stevens, the crack computer of the interplanetary route and a scientist of no mean ability, is on the ship, and so is Nadia, daughter of the owner. It is while Stevens is showing Nadia the ship that the crash comes! A crash impossible to explain until Stevens investigates—only to find that their section has been neatly sliced from the rest of the ship by powerful rays! Infra-red and ultra-violet rays of a velocity and power unknown to the earth or Mars!

Who are these mysterious invaders? What do they want now with the castaways in space?

"SPACEHOUNDS," a new story by Dr. Edward E. Smith, of "Skylarks of Space" and "Skylark Three" fame, is the most thrilling story yet from the pen of this brilliant author. Although AMAZING STORIES published the first of these three years ago, and the second last year, every day still brings request upon request to the publishers for the copies in which these stories appeared.

AND NOW—this new serial "SPACEHOUNDS"—beginning in the July issue of AMAZING STORIES and by the same author, is the most fascinating and amazing of all! Be sure not to miss any issues containing these installments. Sign the coupon on the right, and we will enter your subscription for a special introductory period of 5 months for only $1.00—beginning with the July issue. Or

ASK YOUR NEWSDEALER TO RESERVE YOUR COPIES
JULY ISSUE ON SALE JUNE 5TH—PRICE 25c

AMAZING STORIES

fascinating-fantastic—where the incredible meets the possible!

AMAZING STORIES,
381 Fourth Avenue, New York, N. Y., Dept. 2506.

Enclosed find $1.00, for which please enter my subscription for Amazing Stories for the special introductory period of five months. Be sure to begin my subscription with the July issue, so that I will not lose any of the story "SPACEHOUNDS."

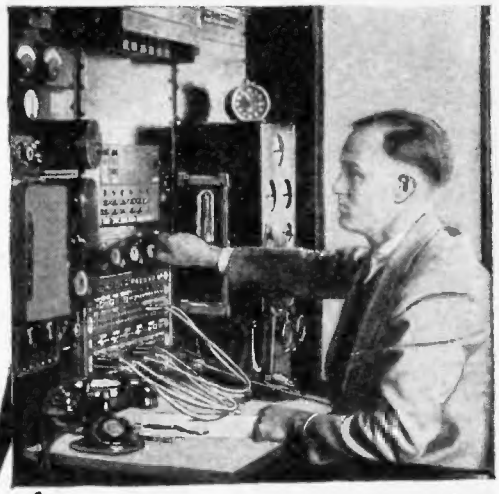
Name.....

Address.....

City.....

State.....

I will train you at home to fill a BIG PAY Radio Job!



Here's Proof

If you are earning a penny less than $50 a week, send for my book of information on the opportunities in Radio. It is free. Clip the coupon NOW. Why be satisfied with $25, $30 or $40 a week for longer than the short time it takes to get ready for Radio.

Radio's growth opening hundreds of $50, $75, $100 a week jobs every year

In about ten years Radio has grown from a $2,000,000 to a $1,000,000,000 industry. Over 300,000 jobs have been created. Hundreds more are being opened every year by its continued growth. Men and young men with the right training—the kind of training I give you—are needed continually.

You have many jobs to choose from

Broadcasting stations use engineers, operators, station managers and pay $1,800 to $5,000 a year. Manufacturers continually need testers, inspectors, foremen, engineers, service men, buyers, for jobs paying up to $15,000 a year. Shipping companies use hundreds of Radio operators, give them world wide travel at practically no expense and a salary of $85 to $200 a month. Dealers and jobbers employ service men, salesmen, buyers, managers, and pay $80 to $100 a week. There are many other opportunities too. My book tells you about them.

So many opportunities many N. R. I. men make $5 to $25 a week while learning

The day you enroll with me I'll show you how to do 10 jobs, common in most every neighborhood, for spare time money. Throughout your course I send you information on servicing popular makes of sets; I give you the plans and ideas that are making $200 to $1,000 for hundreds of N. R. I. students in their spare time while studying.

Talking Movies, Television, Wired Radio included

Radio principles as used in Talking Movies, Television and home Television experiments, Wired Radio, Radio's use in Aviation, are all given. I am so sure that I can train you satisfactorily that I will agree in writing to refund every penny of your tuition if you are not satisfied with my Lessons and Instruction Service upon completing.

64-page book of information FREE

Get your copy today. It tells you where Radio's good jobs are, what they pay, tells you about my course, what others who have taken it are doing and making. Find out what Radio offers you, without the slightest obligation. ACT NOW.

J. E. SMITH, President
National Radio Institute Dept. IFS
Washington, D. C.

$100 a week

"My earnings in Radio are many times greater than I ever expected they would be when I enrolled. They seldom fall under $100 a week. If your course cost four or five times more I would still consider it a good investment."

E. E. WINBORNE
1267 W. 48th St.,
Norfolk, Va.

Jumped from $35 to $100 a week

"Before I entered Radio I was making $35 a week. Last week I earned $110 servicing and selling Radios. I owe my success to N. R. I. You started me off on the right foot."

J. A. VAUGHN
4075 South Grand Blvd.,
St. Louis, Mo.

$500 extra in 6 months

"In looking over my records I find I made $500 from January to May in my spare time. My best week brought me $107. I have only one regret regarding your course —I should have taken it long ago."

HOYT MOORE
R. R. 3, Box 919,
Indianapolis, Ind.,

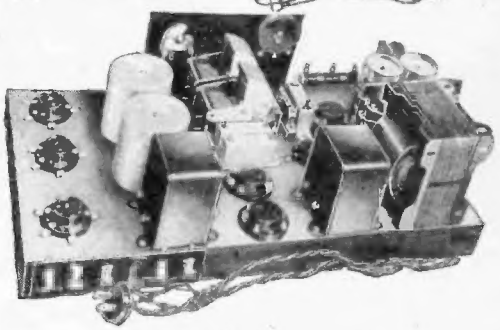
Our Own Home

Pioneer and World's Largest Home-Study Radio training organization devoted entirely to training men and young men for good jobs in the Radio industry. Our growth has paralleled Radio's growth. We occupy three hundred times as much floor space now as we did when organized in 1914.

I will give You my new 8 OUTFITS of RADIO PARTS for a home Experimental Laboratory

You can build over 100 circuits with these outfits. You build and experiment with the circuits used in Crosley, Atwater - Kent, Eveready, Majestic, Zenith, and other popular sets. You learn how these sets work, why they work, how to make them work. This makes learning at home easy, fascinating, practical.

Back view of 5 tube Screen Grid A. C. tuned Radio frequency set—only one of many circuits you can build with my outfits.



I am doubling and tripling the salaries of many in one year and less Find out about this quick way to BIGGER PAY

Radio Needs Trained Men

FILL OUT AND MAIL THIS COUPON TODAY

J. E. SMITH, President,
National Radio Institute, Dept. IFS
Washington, D. C.

Dear Mr. Smith: Send me your book. This request does not obligate me.

Name .....

Address .....

City .....State .....

Lifetime Employment Service to all Graduates

JUNE
1931

Science and Invention

VOL. XIX
No. 2

TABLE OF CONTENTS

Frontispiece 100
Typifying the Spirit of Speedy Transportation

Editorial 101
The Arithmetic of the Infinite

Bali—a Volcano-Fed Eden 103
Hickman Powell paints a fascinating picture of a miniature Garden of Eden

Long Range Weather Forecasting from the Ocean 108
The depths of the sea may yield the secret which will enable us to accurately predict weather conditions for half a year in advance, according to Frank George

Dethroning the Ice King 110
Ice engineers eliminate the blocking of busy harbors with chemicals. By Michael O'Mayo

The Life History of a Splash 113
W. Gorell, Jr., gives us a clue as to the formation of the craters on the moon

Aerial Bullets and Bombs Will Decide the Next War 114
So you will agree, after reading what Gene Day has to say on the subject

The Unseen Menace of Mississippi Flood Control 117
Controlling the "Father of Waters" may result in the sterility of the soil we try to protect, says Murray Godwin

What Makes the Sun Hot? 121
Donald H. Menzel, Ph.D., of the Lick Observatory, discusses many probable causes

Behind the Scenes in a World Renowned Aquarium 122
Little known facts about fish and their care. By Thomas Howley, Fish Culturist of the New York Aquarium

Harnessing the Tides 124
Sir Ambrose Fleming, F.R.S., presents a practical plan for securing cheap electrical power

Byrd's "Little America" Reproduced for the Movies 126
Filming "Dirigible" with the temperature at 110° was no easy job, according to Sterling Gleason

General

Airscapes—The Latest in Architecture 109
By James R. Lowell

Taking 40,500 Photographs per Second 111
By H. H. Sheldon, Professor of Physics, New York University

Some Curious War Inventions 116
By Charles W. Revise, Patent Attorney

Movie "Machine Gun" Checks Aerial Marksmanship 120
By Rene Leonhardt

Forests of Stone 128
By Sydney E. Helprin

Would You Believe It? 130

In the Spotlight of Science 131
Science the world over in eight pages of last minute photos

A Million-Edged Tool 140
By Alfred S. Kinsey, Professor of Shop Practice, Stevens Institute of Technology

Scientific Aids to Your Comfort 149
By Mary Jacobs

The Oracle 154
Conducted by Seymour A. Davidson

The Safety Valve 162

Six Power Binoculars 163

Scientific Book Reviews 185

Science and Invention Announces the Second Prize Winners of the $3,250 Ideal Home Workshop Contest 187

Index to Advertisers 190

Radio

World's Super Amusement Center—Radio City 127

What's New in Radio 144

Construction, Amusement, Experiment

Fun with a Violet Ray Machine 139
By Thomas Molloy

A Nine-Hole Golf Course on a Card Table 142
By Hi Sibley

Magic 143
By Dunninger

An Electric Floor Waxer You Can Make 145
By Gale Vance

New Tools You Can Easily Make 146
By Joseph Pignone

Attractive Furniture for the Smoker 147
By H. L. Weatherby

Building a Drum Sander 148
By M. C. Smock, Jr.

A Workbench from an Old Bedstead 150
By Charles H. Alder

For the Home Machinist 151
By George A. Luers

Things You Can Do for Your Car 152
By Arthur George

Prize Puzzles to Polish Your Wits 153
By Sam Loyd

An Outboard Trailer for $14.50 155

Wrinkles and Recipes 160

An Experimenter Stunts with Atmospheric Pressure 176
By Raymond B. Wailes

A Home-Made Self Bailer for Racing Hydroplanes 183
By John Milton

An Inside Cutting Chisel for Your Lathe 184
By John Horndale

For Inventors

Patent Advice 156

Among the Inventors 158

Published Monthly by **Radio-Science Publications, Inc.**, Jamaica, N. Y.

Officers:

W. Z. Shafer, President
Guy L. Harrington, Vice-Pres.
Laurence A. Smith, Treasurer
Byrd D. Wise, Secretary

EDITORIAL AND EXECUTIVE OFFICES
381 FOURTH AVENUE, NEW YORK CITY, N. Y.

Entered as second class matter at the Post Office at Jamaica, N. Y., under the act of March 3, 1879. Copyright, 1931, by Radio-Science Publications, Inc. All rights reserved. Title Registered at the U. S. Patent Office. Printed in the United States of America. The contents of this magazine must not be reproduced without permission. We cannot be responsible for lost manuscripts, although every care is taken for their safety.

25c a copy, $2.50 a year; $3.00 in Canada; $3.50 in foreign countries. Subscribers are notified that change of address must reach us five weeks in advance of the next date of issue.

BIG PAY JOBS

open

for the Radio Trained Man

Don't spend your life slaving away in some dull, hopeless job! Don't be satisfied to work for a mere $20 or $30 a week. Let me show you how to make **real money in Radio—the fastest-growing, biggest money-making game on earth.**

JOBS LEADING to SALARIES of $60 a Week and Up

Jobs as Designer, Inspector and Tester paying $3,000 to $10,000 a year—as Radio Salesman and in Service and Installation Work, at $45 to $100 a week—as Operator or Manager of a Broadcasting Station, at $1,800 to $5,000 a year—as Wireless Operator on a Ship or Airplane, as a Talking Picture or Sound Expert—HUNDREDS of Opportunities for fascinating, BIG PAY JOBS!

Learn Without Lessons *in* 10 Weeks

Coyne is NOT a Correspondence School. We don't teach you from books or lessons. We train you on the greatest outlay of Radio, Television and Sound equipment in any school—on scores of modern Radio Receivers, huge Broadcasting equipment, the very latest newest Television apparatus, Talking Picture and Sound Reproduction equipment, Code Practice equipment, etc. You don't need advanced education or previous experience. We give you—RIGHT HERE IN THE COYNE SHOPS—all the actual practice and experience you'll need. And because we cut out all useless theory, you graduate as a Practical Radio Expert IN 70 DAYS' TIME.

TELEVISION *and* TALKING PICTURES

And TELEVISION is already here! Soon there'll be a demand for THOUSANDS of TELEVISION EXPERTS! The man who learns Television **now** can make a FORTUNE in this great new field. Get in on the **ground-floor** of this amazing new Radio development! Come to COYNE and learn Television on the very latest, newest Television equipment.

Talking Pictures and Public Address Systems offer **thousands** of golden opportunities to the Trained Radio Man. Here is a great new Radio field just beginning to grow! Prepare NOW for these wonderful opportunities! Learn Radio Sound Work at COYNE on actual TALKING PICTURE and SOUND REPRODUCTION equipment.

No Books - No Lessons

All Practical Work at Coyne

No Books! No Lessons! ALL ACTUAL, PRACTICAL WORK. You build radio sets, install and service them. You actually **operate** great Broadcasting equipment. You construct Television Receiving Sets and **actually transmit your own Television programs over our modern Television equipment.** You work on **real** Talking Picture machines and Sound equipment. You learn Wireless Operating on actual Code Practice apparatus. We don't waste time on useless theory. We give you just the **practical training** you'll need—**in 10 short, pleasant weeks.**

EARN as You LEARN

Don't worry about a job! **You get Free Employment Service for Life.** And don't let lack of money stop you. If you need part-time work while at school to help pay expenses, we'll gladly help you get it. **Coyne is 32 years old!** Coyne Training is tested—proven beyond all doubt. You can find out everything **absolutely free. Just mail coupon for my big free book!**

RADIO DIVISION COYNE ELECTRICAL SCHOOL H. C. LEWIS, President Founded 1899

500 S. Paulina St. Dept. A1-8C, Chicago, Ill.

H. C. LEWIS, *President*

Radio Division, Coyne Electrical School

500 S. Paulina St., Dept. A1-8C, Chicago, Ill.

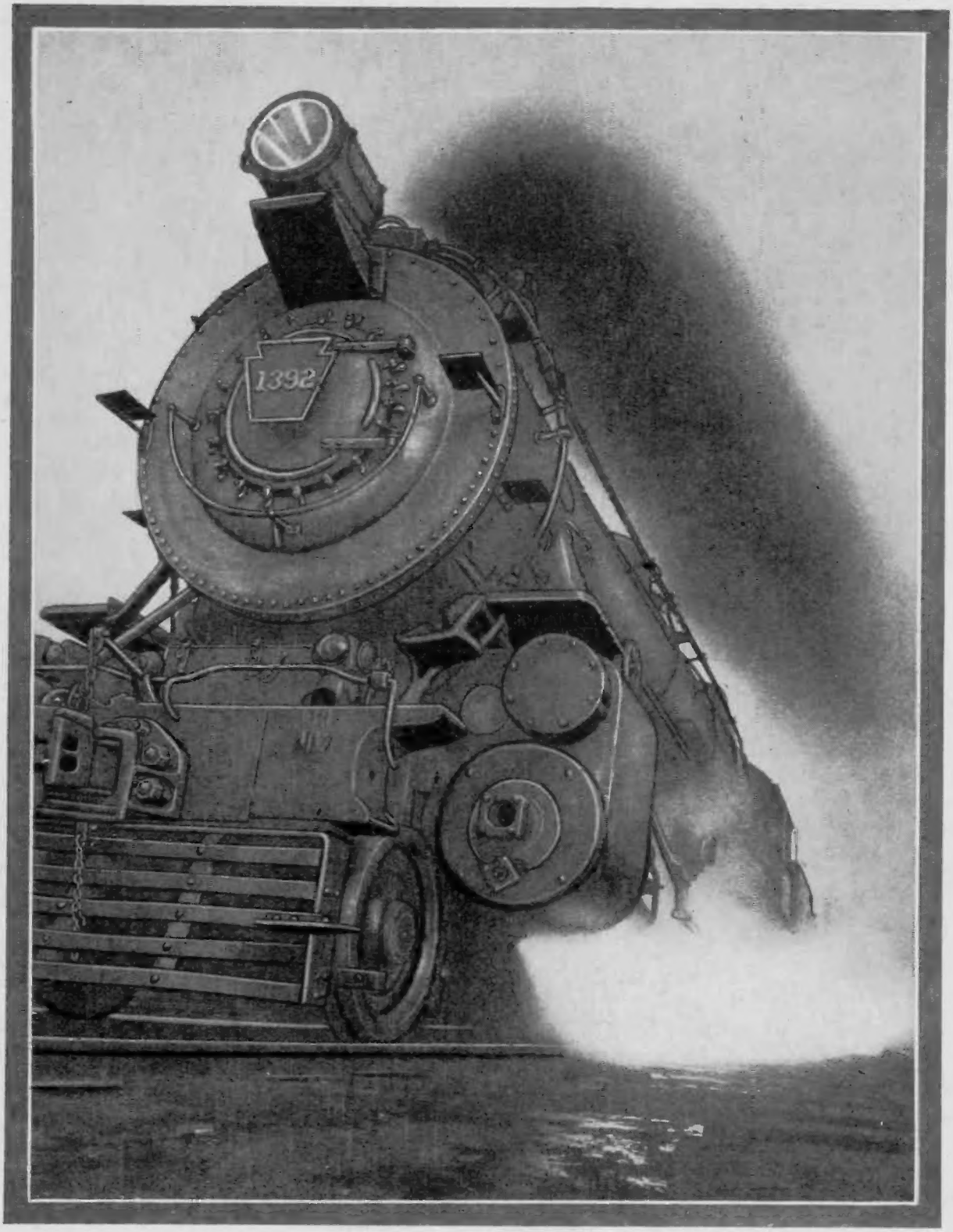
Send me your Big Free Radio Book and all details of your Special Introductory Offer. This does not obligate me in any way.

Name .....

Address .....

City ..... *State* .....

A Conqueror of Space



This Picture of a Giant Locomotive Hurtling Across Country at Full Speed Typifies the Spirit of Speedy Transportation Upon Which Our Modern Civilization So Largely Depends.

JUNE, 1931
WHOLE NO. 218

Science and Invention

NUMBER 2
VOLUME XIX

Published by Radio-Science Publications, Inc., 381 Fourth Ave., New York City, N. Y.
JOSEPH H. KRAUS, Editor

A. DINSDALE, Managing Editor
T. O'CONOR SLOANE, A.B., A.M., E.M., Ph.D., LL.D., Associate Editor
MARY JACOBS, Feature Editor
DR. DONALD H. MENZEL, Astro-physics Editor
AUGUSTUS POST, Aviation Editor
J. PHILLIPS DYKES, Marine Editor
DR. E. BADE, Biology Editor

Editorial

Arithmetic of the Infinite

IN that excellent book, "The Mysterious Universe," Sir James Jeans writes:

"It was, I think, Huxley who said that six monkeys set to strum unintelligently on typewriters for millions of millions of years, would be bound in time to write all the books in the British Museum. If we examined the last page which a particular monkey had typed, and found that it had chanced, in its blind strumming, to type a Shakespeare sonnet, we should rightly regard the occurrence as a remarkable accident, but if we looked through all the millions of pages the monkeys had turned off in untold millions of years, we might be sure of finding a Shakespeare sonnet somewhere amongst them, the product of the blind play of chance."

There is a vast difference between possibility and probability. We might point to a spot on the sidewalk in any of our great cities and say, "Someday lightning will strike this spot." We might tag one single molecule of water, drop it into the ocean and state "eventually this molecule will find its way to the North Pole."

Let us look into Huxley's statements a little more fully. With the 26 letters in the English alphabet, the Burroughs Adding Machine Company has calculated, at our request, that there are 403,291,461,126,605,635,584,000,000 possible combinations of letters. But this is only the number of combinations obtainable with the letters when each letter is used but once. The combinations are infinite when one considers the need for the formation of words such as "abracadabra," where the letter "a" is repeated five times. The chance of a monkey writing such a word as "pseudoproantidisestablishmentarianism," a perfectly logical word, is virtually nil. And what is to stop the monkey from striking the letter "a" millions of times before he even starts on the letter "b"? With the standard typewriter keyboard, disregarding the shift lever entirely, exactly 1,405,006,117,752,879,898,543,142,606,244,511,569,936,384,000,000,000 combinations are possible. When one considers the thousands of words that make up our English language and the possibility of placing the words in a certain fixed order, the problem no longer presents the same aspect.

While it is true that the number of words is finite, the number of combinations, when one considers the typewriter keyboard and the number of words that can be written, is infinite.

The original statement is fantastic and sensational. It means nothing. It is subject neither to proof nor to demonstration. It resolves itself into the task of trying to solve an infinite problem in an infinite length of time.

Spreading Disease with Bullets

FOR a long time scientists held the opinion that bullets fired from a revolver or rifle could not transport infectious germs, because the high temperature produced by the powder theoretically sterilized the bullet. Drs. Guy and Piedelievre recently reported before the Society of Medicine in Paris that this contention was incorrect. They sterilized bullets, sterilized the weapon, and then fired bullets coated with cultures of *Bacillus Prodigiosus* into thicknesses of sterile cotton. Steel plates were placed in back of the cotton, so that the impact of the bullet would produce a very high temperature. In spite of this, the cotton was found to be infected, even adjacent to the point of impact.

Two conclusions may be reached from these experiments. Bullets fired from a dirty revolver are likely to set up infections, even when they do not pass through clothing. Bullets in the next war may be coated with cultures of infectious disease so as to guarantee the complete annihilation of the enemy by insuring the spread of disease from the military to the civil population. How disastrous such a war may be, we leave to your imagination.

The Gold Rush

IN these editorial pages, we predicted another gold rush. All signs tend to point toward the fulfillment of that prediction much earlier than we had anticipated. At the present time, Nevada is experiencing the throes of a new gold rush. Mexico is also attracting much attention. Canada has not yet been forgotten.

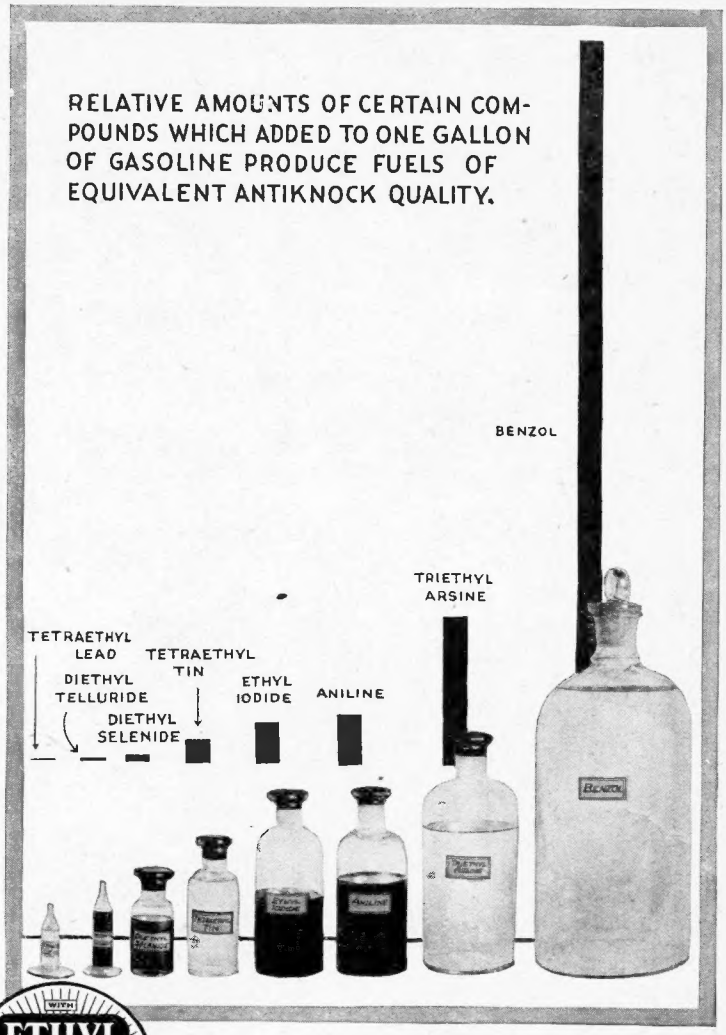
A Safer Anesthetic

WE also anticipated another anesthetic far safer than any of the anesthetics heretofore developed. We were more concerned with electrical methods of producing anesthesia. Drugs producing hypnotic sleep as a substitute for anesthetics were recently described to the American Chemical Society, and the new advances in anesthesia previously predicted now seem more possible through the use of iso, amyl and barbituric acids.

"Those Who Refuse to Go Beyond Fact Rarely Get as Far as Fact" - - - - - - - - HUXLEY

Ethyl is the *most practical* anti-knock ingredient known

Compare!



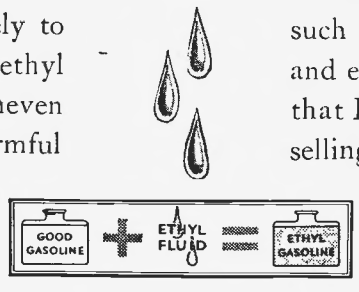
IT took seven years of testing and experimenting to produce Ethyl fluid. During that time, 33,000 chemical compounds were studied.

All the compounds shown in this picture have anti-knock qualities. None of them is nearly so practical as tetraethyl lead, which is the active ingredient in Ethyl fluid. Some are required in such large quantities that more than the total available world supply would be needed to treat all the gasoline requiring anti-knock. Others do not vaporize easily and completely.

Even tetraethyl lead cannot be used alone. It is mixed with other chemicals which combine with it at the time of combustion to form a gas that passes out of the cylinders.

The red dye which is in all Ethyl fluid has nothing whatever to do with its power to control combustion. The dye is added solely to give an identifying color. It is the tetraethyl lead in Ethyl fluid that prevents the uneven explosions that cause power-waste, harmful "knock" and overheating. It *controls combustion* so that power is delivered to the pistons with a smoothly increasing pressure that brings out the maximum performance of any car.

ETHYL BRAND OF ANTI-KNOCK COMPOUND ETHYL GASOLINE CORPORATION NEW YORK U.S.A. Controls Combustion



Good gasoline *plus* Ethyl fluid makes such an improvement in car performance and effects such a saving in operating cost that Ethyl Gasoline has become the biggest selling brand of motor fuel in the country.

Ethyl Gasoline Corporation, Chrysler Building, New York City.

© E. G. C. 1931

ETHYL GASOLINE

JUNE, 1931
WHOLE NO. 218

Science and Invention

VOLUME XIX
NUMBER 2

Bali—A Volcano-Fed Eden

Wooden Telegraph Poles Sprout and Spread into Flourishing Trees; Crops Grow Thrice Yearly in This Miniature Garden of Eden . . . Almost Untouched by Western Influence, the Inhabitants Leisurely Pursue an Ancient Hindu Civilization

By Hickman Powell
Author of "The Last Paradise"

SIX years ago the sacred volcano Batoer, on the little island of Bali in the Dutch East Indies, spat fire and boiled over. Its crater spouted clouds of ashes and poured forth molten lava. This cone rose at the center of a vast bowl in the mountains, which in some prehistoric age had been the crater of a much larger volcano, and now has weathered down to a ragged mountain ridge. Half around the cone's base curved a crescent lake, and by the water's edge lay the village of Batoer.

The god of the mountain was fuming in anger, said the people of Batoer, because of the Dutch explorer who lately had climbed the 10,000 feet to the forbidden brim of the volcano.

The village women carried offerings to their intricately carved stone temple, offerings of fruit and of palm leaves cut and woven into the most fantastic patterns. Their Hindu priest sat cross-legged under a grass roof, tinkling a little brass bell, making mystic signs with his jeweled fingers, and muttering the sacred veda formulas brought ages ago from far-off India. Near by, two dozen men sat pounding the bronze bells of gold-encrusted orchestral instruments, weaving complicated contrapuntal harmonies of traditional music. These people feared the gods of the mountains, bequeathed to them by the Malay and Polynesian ancestors who first inhabited this island. More especially they worshipped the Hindu god Siva, brought by other ancestors, more than a thousand years ago in an invasion, from Asia in the west.

In their peril they trusted Siva the Destroyer, who was also the eternal male principle of generation. Ten years before this the mountain had poured forth lava. It had oozed down to the walls of Siva's temple, but there suddenly it had stopped. Surely the temple would stop it now.

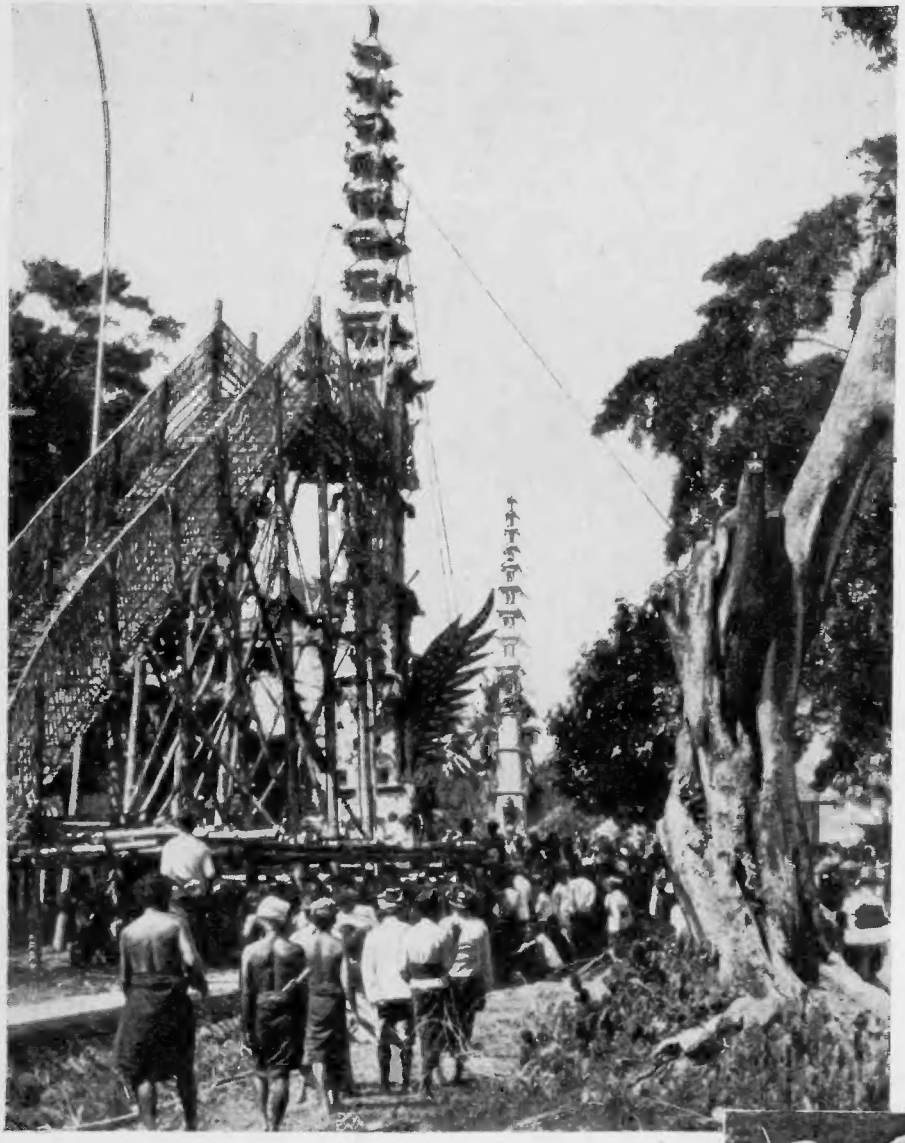
The Dutch resident, down at Singaradja on the north coast, thought differently. He sent a company of native constabulary who, by a solemn show of authority, moved the people up to the near by mountain ridge.

Then the volcano Batoer really broke loose. All its slope burst out in craters. Sulphurous fire and ashes shot to heaven, and lava and boiling mud came down in torrents. The villagers saw their bamboo and grass houses flare up like matches, and the molten stone poured in, filled up and covered their stone-walled compounds. They built a new village on the ridge.

Two years later a Dutch geologist came and drilled a hole to sound the black lava crust where the village had been. He found the lava 100 feet deep. Down where the village had been it was still alive at a temperature of 900 degrees Centigrade.

All of this was a very sad misfortune for the people of the village of Batoer, but for Bali it was part of an age-old blessing. The chemistry of nature had paid another dividend. For it is this volcanic action which has made Bali a Garden of Eden, where just a little work makes the people rich

Batoer Village, before it was buried by a lava flow one hundred feet deep. To the right of the Hindu temple can be seen Mt. Batoer, the sacred volcano.



The deceased noble is wrapped in a hundred yards of white cloth and carried to the top of the specially built 40-foot bamboo pyre.

As can be seen, all the countryside gathers for the two-day burial festivities. Great bulls are built as funeral pyres.

and gives them leisure to carry on, almost untouched by western influence, an ancient civilization of Hindu religion and art.

The Malay archipelago stretches out from southeastern Asia, skirting north of the Indian Ocean, more than 3,000 miles eastward into the Pacific, a conglomerate sprinkling of thousands of islands, so many and varied that no one has ever been able to count them. Its backbone is a chain of volcanoes.

Sometimes these living mountains wreak appalling damage. The tiny island Krakatoa, just west of Java, was half blown away in 1883, its eruption killing thousands of persons by lava and the force of its tidal wave, which was felt even in the River Thames.

Krakatoa's floating ashes reddened sunsets all around the world. Krakatoa erupted again in 1928. Java itself, a phenomenally wealthy island of 25,000 square miles, supporting 35,000,000 people, has forty-five volcanoes, many of them active. Sumatra has ninety, and Bali, just east of Java, is a clump of a half dozen volcanoes, of which Batoer is the only active one.

The volcanoes have been particularly kind to Bali. Rearing to a solid height of 10,000 feet, they grasp torrents of rain from the moist winds of the Java Sea. The mud and ashes they have tossed up are laden with all manner of rich fertilizing chemicals, which the rains wash down over gentle slopes toward the sea, continually renewing the soil without the danger of disease from animal fertilizers such as are used in other crowded lands. The heaving earth has left no fever-breeding lowlands; and it has provided the island with an ironbound coast. This lack of a harbor is in one sense an economic disadvantage, but it is a real advantage in that it has kept out the Mohammedan trade and invasions which centuries ago wiped out the great Hindu civilization from Java and other neighboring islands. Not until twenty-five years ago, when the Dutch came with firearms, was South Bali conquered. It still retains its national identity and pastoral charm.

Scientific agriculture is a stern necessity to the farmer of the American plains if he is to survive, but in Bali it would be almost like carrying coals to Newcastle. Native engineering genius has aided the process through the centuries by cutting the hillsides into step-like terraces, a Herculean labor which has meant the moving of cubic miles of earth, so that irrigation sluiceways carry the mountain water over all the hillsides and keep it standing deep in the terraces at rice-sprouting time.

The result is that Bali is one of the richest spots on earth. Half of its 2,000 square miles is mountainous, and its lower slopes support more than a million people in health and abundance, at a density of a thousand to the square mile.

The land raises three crops a year with very little labor; and while a respectable rice yield in Texas is ten 180-pound bags an acre, a single Bali crop will exceed twenty larger bags for the same area. So fertile is the soil that the Dutch rulers have had to start using metal poles for their telephone lines, for wooden poles, when planted, sprout and spread into flourishing trees.

Thus there is plenty of food for everybody and the island exports huge quantities of rice, coffee, cocoanuts, cattle and swine. The needs of the people are so simple that exports always exceed imports and there is a continual flow of money into the island.

The island's domestic life is of such simplicity, even among the higher classes, that you would scarcely suspect its wealth. Aboriginal customs survive much in village life, which is of a close-bound community structure approaching a primitive communism. Nobody—man or woman—wears clothes above the waist, and the place is like a garden

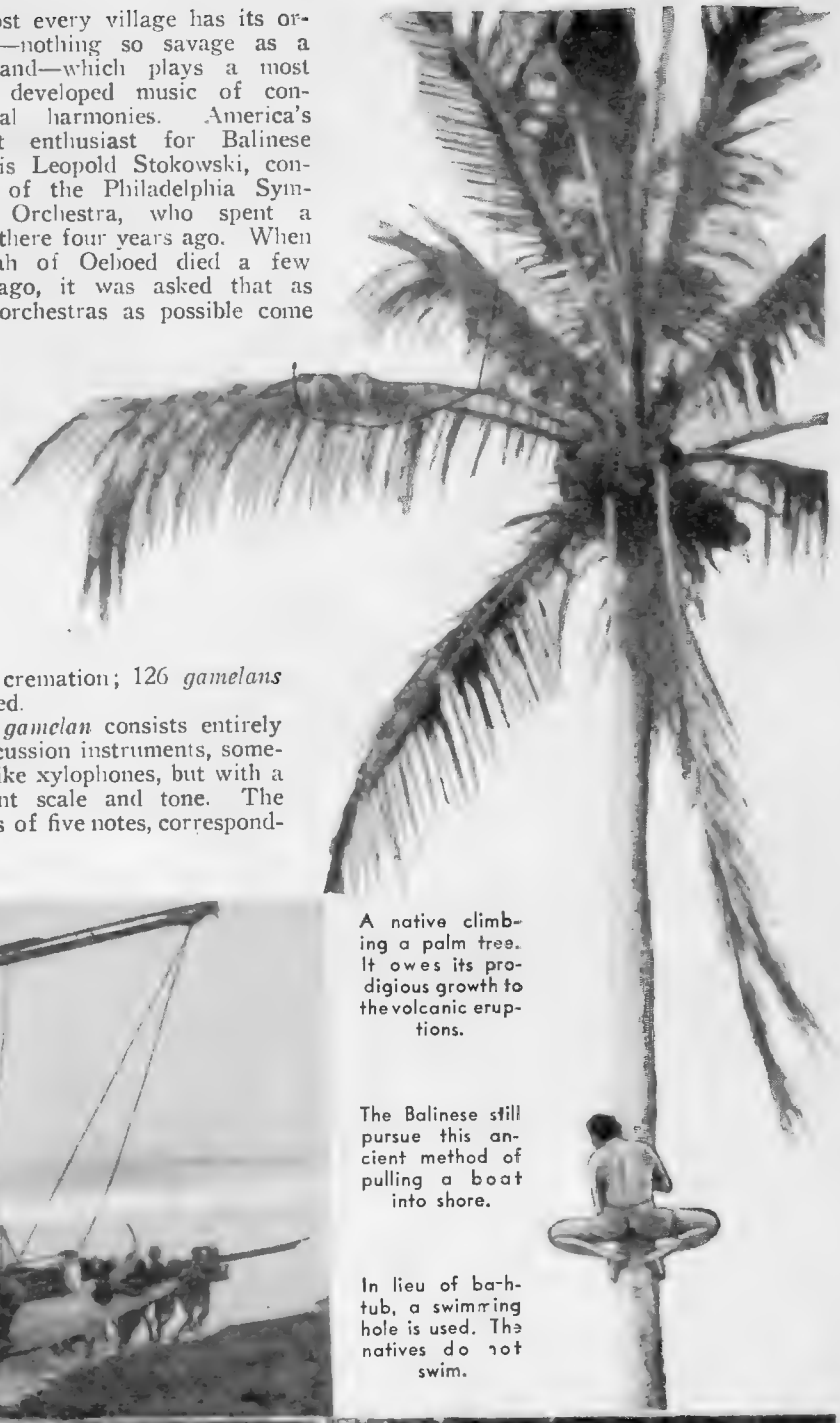
teeming with living statues. The women's ear-lobes are pierced and stretched, so that they can wear ear-tubes of palm-leaf or silver a full inch in diameter. In some classes the custom survives of filing the edges of men's teeth at puberty, and women's at marriage.

Polygamy is practiced, and except among the noble classes marriage is always consummated by elopement or a mock abduction. A woman marries only by her own consent, but when her marriage day comes she is seized by the friends of the bridegroom and dragged down the village street, fighting like mad against her captors. Then her father pretends great surprise and anger, beats the bamboo bell in the village watchtower, and summons the village to a mock hunt which goes on with great energy—but never invades the home of the bridegroom. Not for several days is the father appeased, and then with studied reluctance accepts the marriage price from the emissaries of the young husband's father. According to tradition, had the bridegroom been found during this period he might have been killed.

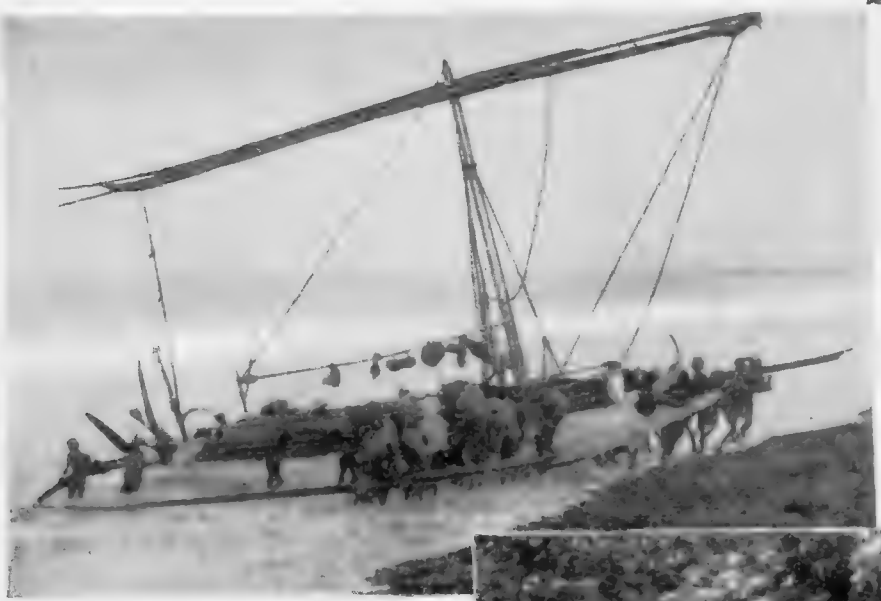
The women do a great deal of the heavy work. The roads stream with girls carrying great loads of rice or cocoanuts on their heads.

Almost every village has its orchestra—nothing so savage as a jazz band—which plays a most highly developed music of contrapuntal harmonies. America's greatest enthusiast for Balinese music is Leopold Stokowski, conductor of the Philadelphia Symphony Orchestra, who spent a month there four years ago. When a Rajah of Oeboed died a few years ago, it was asked that as many orchestras as possible come to his cremation; 126 *gamelans* appeared.

The *gamelan* consists entirely of percussion instruments, somewhat like xylophones, but with a different scale and tone. The scale is of five notes, correspond-



A native climbing a palm tree. It owes its prodigious growth to the volcanic eruptions.



The Balinese still pursue this ancient method of pulling a boat into shore.

In lieu of bath-tub, a swimming hole is used. The natives do not swim.

To Americans it may seem strange to call this country—where a young man may casually run up the trunk of a tree to get a cocoanut—a highly civilized nation. Yet it is the repository of an ancient and highly sophisticated culture—that of the Hindu religion, carried on with all its glamorous beauty, without the squalor and horror that have come to be associated with it in British India.

Bali is the vital survivor of a vast empire that was in these islands a millennium ago. The people spend their leisure—of which they have more than anything else—in the practice of music, dancing, temple building, and great religious festivals, on which they spend their energy and wealth.

A flapper of the Island of Bali . . . The inhabitants are of mixed Malay, Polynesian, and Hindu ancestry, and have no negro blood.

ing to our *mi, fa, sol, ti, do,* omitting the *re* and *la* of our notations. Each of these notes is fractionally different from ours, and intentionally no octave is ever exact, giving the music an entirely different feeling from western harmony.

The basic type of instrument is of five bronze bars, strung on rawhide, each over a bamboo sounding chamber, which gives a warm deep resonance. These range through a half dozen octaves, like the violin family. Then there are long racks of pudding-shaped bells, and great gongs, a yard or more in diameter, imported from Java. With drums and cymbals, there are thirty or more instruments in a full orchestra.

Night after night the musicians sit playing the most complicated music all from memory, which has been handed down through the ages, for none of it is written.

The men of a village in which I stayed were making new instruments for their orchestra. Imported teakwood was delicately joined into frames for the bronze and bamboo, then each instrument was elaborately carved into the most complicated of floral patterns. Then all was overlaid with gleaming gold leaf. Months of labor were put into it by this village of forty men, without pay, and the material alone cost them $1,000. In strange contrast, a few yards away, their women were trading in the market for the simple necessities of life, with coins worth one-twelfth of a cent.

Each village has its dancers. There are adult dancers, who wear the most terrifying masks, and perform dance dramas which last from midnight until nearly dawn. There are clubs of young men and girls who dance away the evenings. There are *dalangs* who entertain with shadow-plays, throwing richly cut puppet figures of Hindu mythological characters on a screen throughout the night. But especially typical are the dances of children.

Two girls perform the sacred *legong* dance. They start training at the age of four, and at eight become the official dancers of their village temple. At twelve they are retired and return to ordinary village life, for so quick and rigorous are the flutterings of this classical dance that only the smallest persons can move quickly enough. These children wear on their heads crowns of pure gold flowers, weighing three pounds; and their green robes are all overlaid with patterns of gold leaf. Underneath, their torsos are bound tight with elastic cloth, like a race-horse's ankle, to support their tendons.

Every village has temples. There are thousands in the island, always falling rapidly to ruin, from earthquakes and pouring rainfall, and always being replaced by new ones. An old temple is never repaired, but every village has sculptors who carve its stone walls and gates into amazing complications of flower patterns and images of Hindu gods—Brahma, Siva, Vishnu, and all their hundreds of lesser deities. More common things, such as tigers and monkeys, also are carved on the walls; and in North Bali, near Singaradja, where there is a motion picture theatre, the influence of the west can be seen. For instance in one temple, on either side of a gate which might be a thousand years old, are two carved panels: one shows a comical bandit with a pistol, holding up the passengers in an automobile; the other shows two airplanes fighting. There are bicycle riders on several temple walls.

Every village has great temple feasts twice a year, when the women come with offerings piled six feet high on their heads, and the men come wearing robes woven into exquisite patterns with gold thread. But the greatest festival is a cremation. The dead are buried and kept underground until someone of great importance dies, and that is the signal for a great celebration. The bodies are all dug up—perhaps a dozen and perhaps as many as two hundred.

Meanwhile all the country around has been at work building great bamboo pylons, like pagodas, forty feet high, all decorated with varicolored papier-mache and richly woven *kains*. These are hearses for the high born people, carried on the shoulders of dozens of men. Great bulls are also built, as funeral pyres for the nobles, and there are

Percussion instruments are all the rage in a Bali orchestra. The trompong player strikes any of ten bells, shaped like plum pudding, to evoke music.

all manner of beasts and fish for the common people.

Thousands of people gather from all the country-side for two days of feasting. There is dancing and music throughout the day and night. For a funeral is not a mournful affair. The souls of the dead have been wandering on the face of the earth, but now by cremation will be released to go to one of seven heavens, according to their merit. In later years each soul will return again to Bali, not in a new-born infant, but entering gradually into the body of a little child as it plays beneath the palm trees.

On the third day is the procession to the cremation ground. Thousands of women carry offerings on their heads. Thousands of men, straining beneath the weight, carry on their shoulders the great pylons. Orchestras play and all the route of the procession is a great swirl of pageantry. The women make offerings at the field of death, sprinkle holy water, and break the pottery vases they have borne upon their heads.

Women do most of the heavy work. You can see them with a bundle of rice or cocoanuts on their heads; in the market place with a pig tucked under each arm.

Arriving at the field, the men break into a run. Three times around the cremation ground the procession moves, the great tall pylons careening and creaking, men shouting, gongs booming. Then the bodies are burned, each separately, and flame and smoke leap from dozens or hundreds of pyres. Finally the ashes are gathered up and carried to the sea, or to the nearest stream.

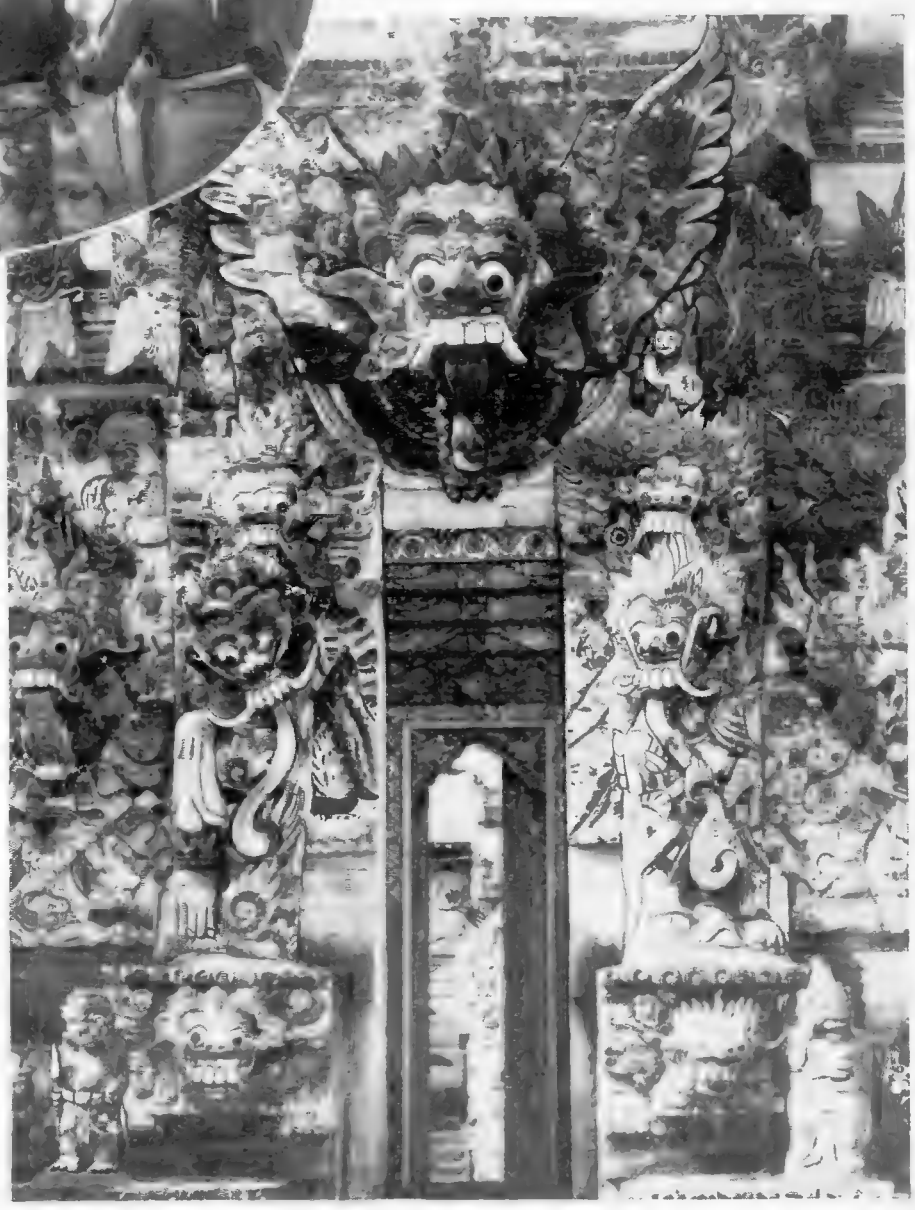
But around the pylon of the Rajah or great noble, whose cremation is the center of the festival, surges the most intense drama. His remains, wrapped tight in matting and shrouded in a strip of white cloth perhaps a hundred yards long, are carried high on a pylon, forty feet tall. At the cremation ground this is set down by a sloping bamboo runway that has already been built there, as is shown in the accompanying illustration.

Up upon this runway presses a throng of half naked men, thick as a subway rush, to take the body. First over the heads of the crowd, passed from hand to hand, comes the long white winding sheet. With barbaric shouts men seize it and over the field it goes, like a great white serpent, undulating over the crowd, until gradually it is led into the ornate bull which has been prepared as a coffin on the pyre.

Then over the heads of the crowd, so closely packed that it is like a sea of upraised hands, comes the body. The shouts are now an uproar, sweat streams from amber bodies, and the air is filled with dust like smoke, as the men break into a great battle over the corpse. Like a pushball the Rajah's body moves overhead, as the throng fights like an army of madmen. This is not so barbaric as it seems, for a drama is being carried on. Half the men are shouting that the body must be taken away and burned; the other half is fighting this inevitable fate with mock earnestness, shouting that this dear Rajah must not be taken away. But gradually it moves toward the bull prepared for it, and is burned with the rest.

The Balinese are exceedingly thrifty persons, and their daily needs are the simplest, so that steady profits from agriculture are hoarded into comfortable family fortunes. But at cremation time there is no thrift. It is for this time that the money has been hoarded. The cremation of a great man may cost as much as $30,000, besides all that the common people may pay for their simultaneous funerals. Cremation is a part of religion, and that to them is something worth spending money on.

And so it is that in this tropical garden, where the destructive forces of nature have somehow paradoxically suspended the struggle for existence, where there is none of the economic competition (*Continued on page* 159)



Thousands of temples, ornately decorated, have been built on the island. Every village has sculptors who carve the stone walls and gates into amazing complications of flower patterns and images of the hundreds of Hindu gods the inhabitants worship.

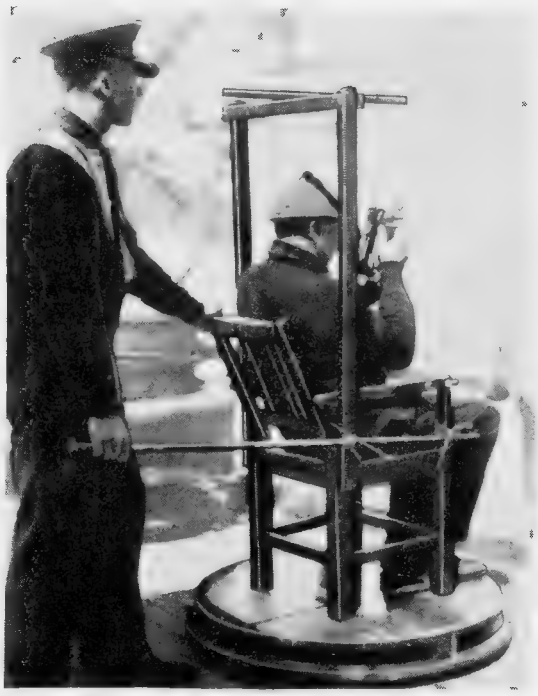
Long Range Weather Forecasting from the Ocean

The Formula for Making Accurate Weather Reports for Half a Year in Advance May be Conjured from the Depths of the Sea. Western Scientists Have Actually Foretold Seasonal Rainfall by Utilizing Oceanographic Data

By Frank George

FOR decades scientists have explored the heavens in search of the forces that shape the future course of the weather. They have spent years of isolation in desert and on mountain top studying sunspots and other meteorological phenomena. They have built huge telescopes with power to bring into view stars and planets invisible to the naked eye. They have delved the depths of the sea for some indication of what is likely to be the weather six months hence.

Now from two separate authoritative sources—the Coast and Geodetic Survey at Washington and the University of California Institution of Oceanography—comes the revelation that out of the sea may be constructed the formula for long distance weather forecasts. The California scientists have already forecast seasonal rainfall on the West Coast with a remarkable degree of accuracy with oceanographic data. Encouraged by their success, they have undertaken to make seasonal forecasts of temperature as well.



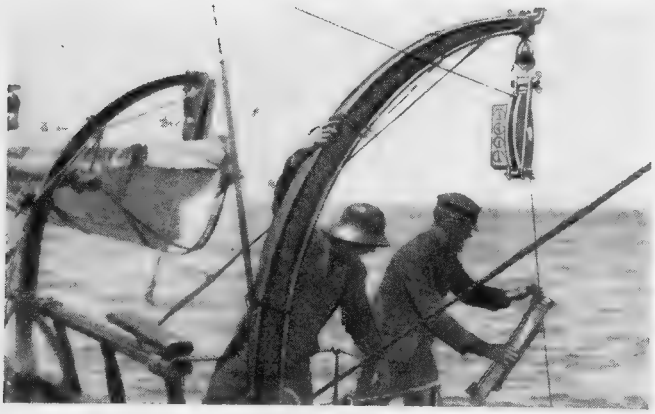
Observers aboard ship can study atmospheric conditions in relation to ocean temperatures, while seated in this rotating chair.

The basis for the seasonal rainfall forecasts on the West Coast is the average temperature of inshore ocean water in the Pacific. The forecast is made in October and covers the winter season in California and the Pacific Coast states. The forecast made in October, 1929, was, for a deficient seasonal precipitation for California, and the accuracy of this forecast was established by the rainfall records for the season ending in September, 1930. The California scientists predict that California will have a greater rainfall during the decade from 1930 to 1940 than has been recorded in the ten years from 1920 to 1930, a forecast predicted on the present trend of sun spot numbers and the decidedly deficient rainfall of the last 15 years.

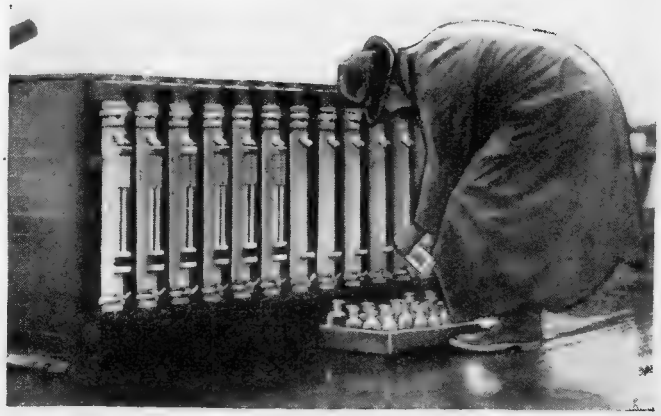
"Attempts to predict for a year at a time or for a quarter season," says Dr. A. F. Gorton of the California Institution of Oceanography, "must necessarily be based on the observed trend of meteorological elements in various parts of the world during the preceding quarter or six months. This statement, of course, predicates a dominance or control exercised by distant centers of action upon the weather of other regions. However, there is good evidence that such control exists, as shown by the success of the Indian monsoon predictions, seasonal forecasts for Java, and by the very recent correlation of winter temperatures in central Canada with antecedent summer conditions in India.

"By a process of elimination it has been shown that certain indices have a significant bearing on the precipitation of California, but more especially on that of southern California. Of these the most outstanding at present is the average summer temperature of coastal waters at two stations in the south Hueneme (Oxnard) and La Jolla. Comparing these with the precipitation records, it is found that the correlation coefficient has a value of 0.84 with a record of successful forecasts of nine in twelve years."

The California scientists point out that southern California, like northern Chile (*Continued on page* 161)



This battery of water bottles scoops up samples of sea water and automatically records temperature at different depths.



Unhooking a water bottle and thermometer; the device overhead records the length of wire run into the sea.

An airview of the airport at Fairfax, Neb., taken from 1500 feet, showing extensive landscape designing around the administration building.

Airscapes— The Latest in Architecture

By James R. Lowell

MOTION picture directors, authors of scientific fiction and cartoonists are drawing upon their imaginations for predictions as to what the world may expect a few decades hence in the appearance of our cities and towns as influenced by aviation. Visions are painted of a landing field on every roof, and cities erected around central airports. Just how far-fetched such developments may be no one can say, but it is a fact that in Lincoln, Nebraska, a step of considerable importance and of an entirely practical nature has been made in that direction.

A new residential district has been laid out in Lincoln, designed, for the first time on record, with an eye to its appearance from the air. A formal type of landscape architecture was used, and the effect may be judged from the photograph accompanying this article.

Ernst Herminghaus, Lincoln landscape architect, designed this new residential district, which, incidentally, occupies a part of the same field at which Colonel Lindbergh learned to fly. Mr. Herminghaus may be classed as America's pioneer air-minded landscape architect. He has studied aviation as a factor in landscape architecture and gardening, park design and city planning for a number of years, and besides the new sub-division in Lincoln he has designed several other projects with an eye to their appearance to the air traveler. These include parks at Clay Center and Madison, Neb., and Fairfax airport at Kansas City.

Most cities look much alike to the air traveler, and aside from rivers and lakes the only thing that strongly attracts the eye from above is a formal design of landscape architecture. This engages the attention immediately and gives the same sort of pleasure that one derives from a perfect geometric figure amidst random lines.

"From the air one looks down upon the earth as if it were a great map," says Mr. Herminghaus. "Consequently, landscape designs will be viewed as one sees a plan of them on paper, and they are necessarily just as attractive from the air as they are on the plan. The viewpoint is somewhat different; from above, there are essentially only two di-

(*Continued on page* 163)

Below — Woodsshire residential district of Lincoln, Neb., as seen from a height of 2000 feet. This is believed to be the only residential district in the world designed with an eye to its appearance from the air. Its site occupies part of the field at which Lindbergh learned to fly.

Left—Airview of city park at Clay Center, Neb., showing formal landscape design laid out so as to be attractive looking when viewed from the air. Below—Airview of a typical residential district in an American city, not laid out so as to be pleasing when seen from the air.

Effect of ice-breaker on ice pack immediately after chemical treatment.

Dethroning the Ice King

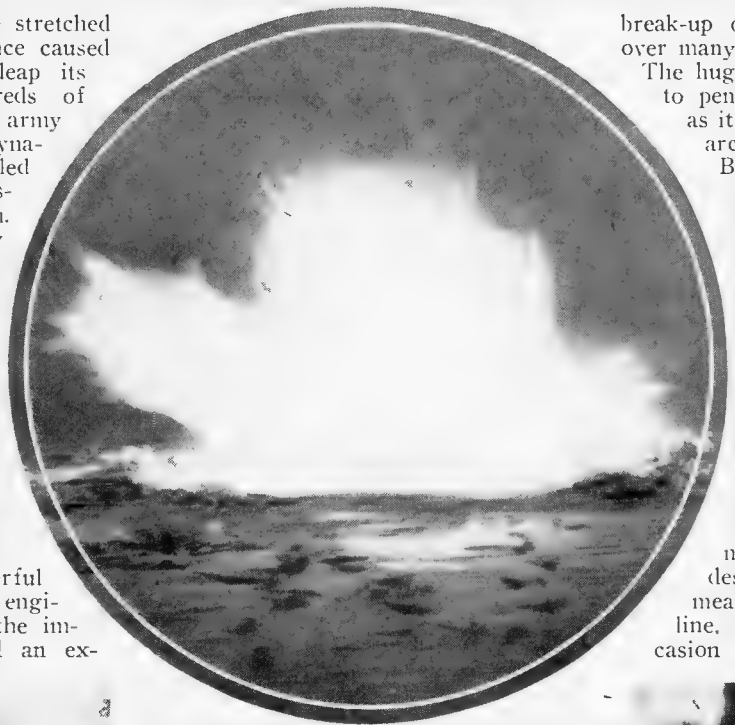
Towering Walls of Ice no Longer Threaten the Destruction of Entire Cities or Lock Busy Harbors for Many Months

By Michael O'Mayo

ONE million tons of ice stretched across the St. Lawrence caused the mighty river to leap its banks and menace hundreds of farms and villages. A small army of daring men, armed with dynamite and T. N. T. had failed to make the slightest impression on that crystalline dam. For thirty-six hours they had battled, only to confess failure.

A hurried call for help was wired to McGill University and brought Dr. Howard T. Barnes of that institution on the run. With him came two ninety-pound charges of thermite which destroyed that monster ice jam in a couple of hours!

Thermite is one of the latest and most powerful weapons devised by ice engineers. By no stretch of the imagination can it be called an explosive. It is a combination of iron oxide and aluminum powder which is touched off with a fuse or a small charge of flashlight powder. Shooting streams of molten steel through the ice in all directions and generating a temperature of more than 5,000 degrees, it literally decomposes the ice into its constituent elements oxygen and hydrogen. The latter ignites so that tongues of flame leap one hundred feet and more into the air.



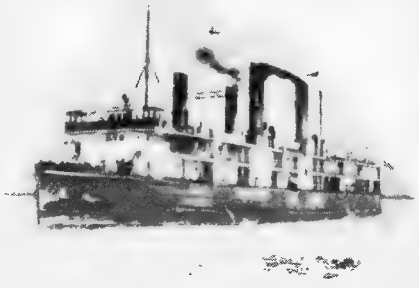
100 pounds of thermite used on the St. Lawrence.

Huge holes are torn in the ice. Tremendous cracks develop. At intervals thunderous reports are heard as the break-up of the mass of ice extends over many hours.

The huge cracks enable rays of light to penetrate the ice. For, strange as it may seem, light is one of the arch-enemies of Jack Frost. Dr. Barnes has proved that the green and the yellowish-green rays of the spectrum are more potent than heat in this regard. By opening up the ice mass to these rays, the work of decomposition is considerably accelerated aided by the melting-powers of the surrounding water.

Brought to perfection by Dr. Barnes, thermite has proved itself as one of the most destructive weapons of the ice engineer. Last summer a single 100-pound charge destroyed an iceberg which measured 500 feet at the waterline, and on more than one occasion serious floods have been averted by the timely employment of this weapon.

Lowering thermite into shallow holes dug in the ice. Dr. Barnes can be seen on the left.



S. S. Prince Edward Island ice-breaker in Northumberland Strait.

12 pounds of solite, the new ice-destroying material, reaching under the ice.

Quite recently Dr. Barnes has perfected another weapon against icebergs and ice-jams known as solite. It is equally as deadly as thermite, but has the added advantage of not needing a fuse or electric battery. Dropped as a bomb on an iceberg or ice-jam, it bores its way into (*Continued on page* 165)

Taking 40,500 Photographs Per Second

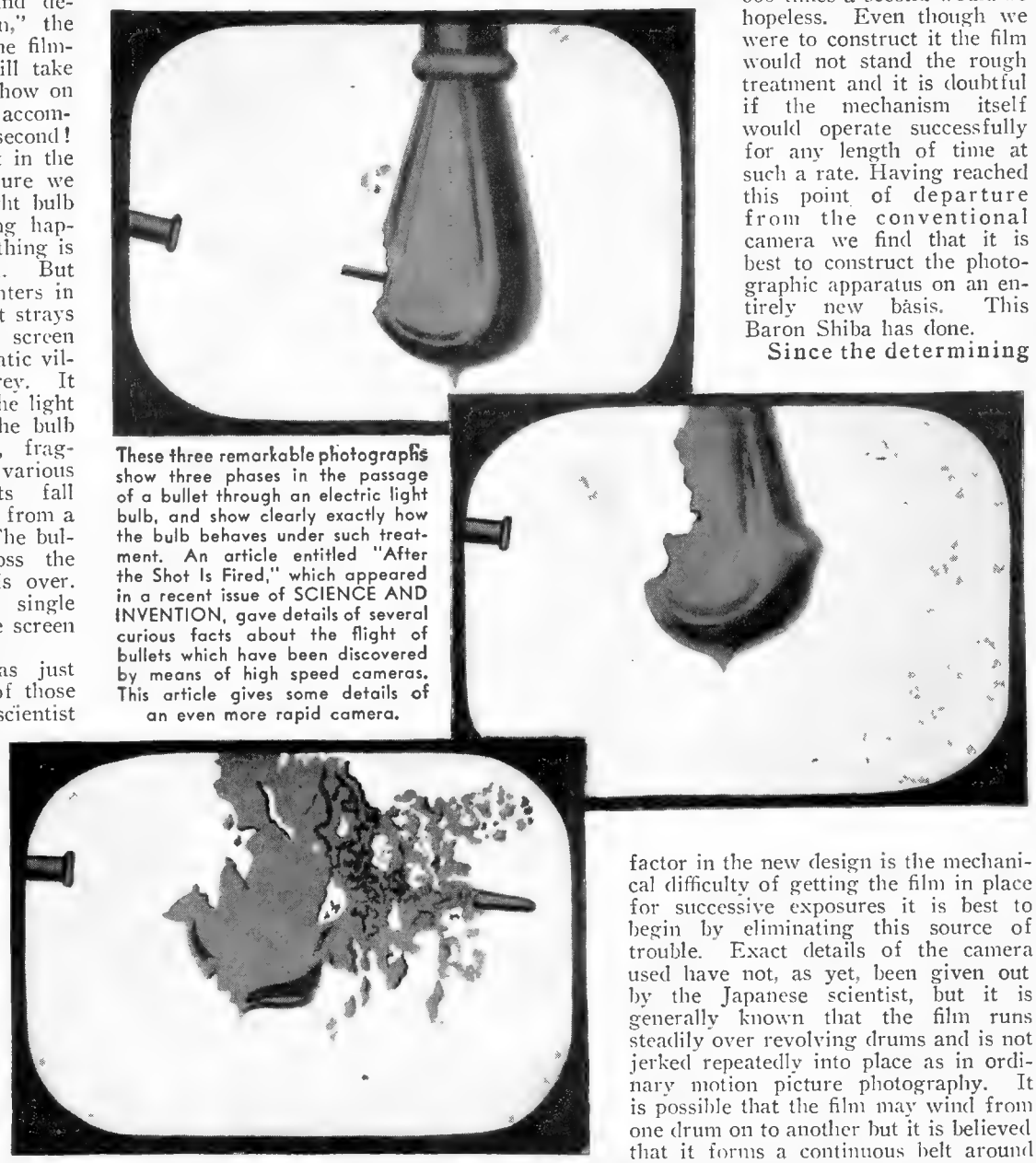
By H. H. Sheldon

Professor of Physics, New York University

IMAGINE the old time pre-sound motion picture director. "Camera, lights," he shouts. But before he can tear his hair and curse in typical movie director style and demand, "action — action," the scene is at an end. The filming of a scene that will take more than an hour to show on the screen has been accomplished in but a single second! When we take our seat in the theatre to see this picture we see a single electric light bulb on the screen. Nothing happens. It seems that nothing is ever going to happen. But eventually the villain enters in the form of a bullet. It strays as leisurely across the screen as did ever a melodramatic villain, certain of his prey. It approaches its victim, the light bulb, it touches, and the bulb begins to disintegrate, fragments of it going in various directions. The parts fall more gently than petals from a rose on a quiet day. The bullet continues on across the screen and the show is over. The event of but a single second has occupied the screen for an hour!

The picture that has just been described is one of those taken by the Japanese scientist Baron Shiba, director of engineering of the Aeronautical Research Institute of Japan, and was filmed at the astonishing rate of 40,500 pictures per second! The average slow motion picture is taken at from about eighty to 125 pictures per second. These super-slow Japanese pictures slow down motion to one twenty-five thousandths of actual speed. The usual slow movie slows down motion in the ratio of about one to six! At the super-slow rate a hundred yard dash would require about seven hours for showing. An airplane traveling at the racing speed of 250 miles per hour would drift across the screen as if its actual speed were but a tenth of a mile per hour—a very slow motion, hardly more than perceptible.

Of course it would be absolutely impossible to take any such pictures as have just been described with anything that even resembles the usual motion picture camera. We could perhaps make a shutter that would open and close 40,000 times per second if we were to use a revolving type. Shutters have been made to give single exposures this short. It is even possible that by using powerful lights and sensitive films we might still be able to use a camera of more or less conventional design. But here the possibility ends. To build a mechanism to jerk a film into place 40,000 times a second would be hopeless. Even though we were to construct it the film would not stand the rough treatment and it is doubtful if the mechanism itself would operate successfully for any length of time at such a rate. Having reached this point of departure from the conventional camera we find that it is best to construct the photographic apparatus on an entirely new basis. This Baron Shiba has done.



These three remarkable photographs show three phases in the passage of a bullet through an electric light bulb, and show clearly exactly how the bulb behaves under such treatment. An article entitled "After the Shot Is Fired," which appeared in a recent issue of SCIENCE AND INVENTION, gave details of several curious facts about the flight of bullets which have been discovered by means of high speed cameras. This article gives some details of an even more rapid camera.

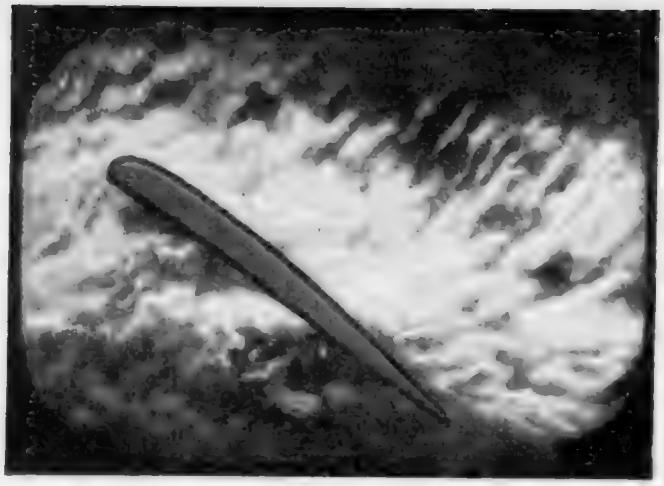
Since the determining factor in the new design is the mechanical difficulty of getting the film in place for successive exposures it is best to begin by eliminating this source of trouble. Exact details of the camera used have not, as yet, been given out by the Japanese scientist, but it is generally known that the film runs steadily over revolving drums and is not jerked repeatedly into place as in ordinary motion picture photography. It is possible that the film may wind from one drum on to another but it is believed that it forms a continuous belt around two large drums. This requires that the drums be run by synchronous motors so that there will not be a stress on the film which would cause it to break. The actual speed at which the film runs has been given as 2,160 miles per hour! Obviously large drums running at very high speed are required.

So far we have merely succeeded in

moving the film at the high speed required. How are we to make our successive exposures? This is done by using a light source which, in itself, is light source and shutter as well—an oscillatory spark. The spark gap is made to form a part of a tuned oscillating circuit. The film is in place for an exposure—the spark flashes and goes out. While it is off, the continuously running film reaches the position for the next exposure. Again the spark flashes and the next exposure is made. So exposure after exposure is made until the filming is complete. It will be noted that the period of the spark must be carefully synchronized with the motion of the film. The pictures must be taken end to end. If the spark is too slow there will be a blank space between the successive pictures; if it is too fast the pictures will overlap. Either of these conditions would make the film impossible to show on the screen with the usual apparatus. The first condition could be remedied by cutting the pictures apart and laboriously joining them again end to end. The condition of overlapping pictures cannot be corrected.

The mechanical difficulties having been taken care of, as described, we have next the difficulty of getting film sufficiently sensitive to take pictures at the enormous rate of forty thousand a second. The spark helps in this direction since it is rich in ultra-violet light, to which photographic film can easily be made very sensitive. Illumination is also gained by taking the pictures as shadowgraphs. The object to be examined is placed between the spark and the camera. What we see on the film are the shadows where the intense light from the spark has been cut off rather than the light reflected from the object, as in ordinary photography. But this would, perhaps, still give us insufficient light if every possibility of increasing the sensitivity of the film were not employed. It is probable that the film is coated with a special emulsion which has been further sensitized by heat treatment, by ammonia fumes and perhaps by a pre-exposure as well. When films have been gradually exposed to light they eventually reach a point where a slight additional exposure is tremendously effective. It is quite likely that Baron Shiba has utilized this fact in making his remarkable high speed pictures.

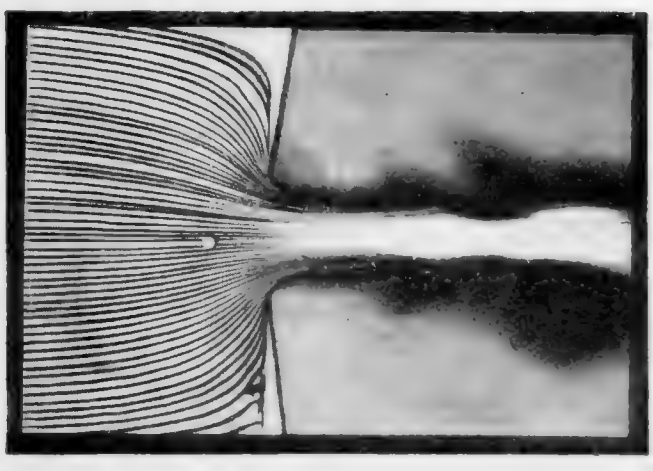
A few years ago there were exhibited in this country the first pictures that the Japanese scientist had taken. These were pictures of the air flow around propellors and around airplane wings of various designs. They were photographed at the rate of about 20,000 per second. But how was it possible to photograph air flow? Can the camera photograph things which are transparent? In so far as air is concerned the answer to this is yes. In the motion pictures the air moves leisurely around the obstruction with all the appearance of a milky liquid of a viscosity about that of a thick syrup. A study of the air motion in this manner offers a possibility of greatly improving the design of airplanes. Let us see how it is done.



Air currents passing over an airplane wing. Photographed at ultra-high speed.

When one looks at an object across the top of a hot radiator one is likely to see a wavy appearance above the radiator which distorts the image of the object viewed. These waves are often mistakenly referred to as heat waves. They can be seen over a hot pavement or over hot rails on very hot summer days. The wave-like appearance is produced by the bending of light from the object as it passes over the heated surface: the bending being due to the passing of the light through regions of various atmospheric densities. Light is bent as it passes through a lens or prism for this same reason. The glass of the prism has a density different from that of the air around it. Heated air expands and its density is thereby decreased. As the heating, and therefore density varies from point to point we get bending of the light rays which produces the peculiar wavy effects so commonly seen over heated surfaces.

In ordinary photography we would never register such waves on our film, for the film would sum up the whole effect over the time of the exposure and, on the average, one part of the film would receive as much light as another. If we take our photograph in a forty-thousandth of a second, however, the exposure is over before the density at any point has had time to change materially. Thus, parts of the film will have received more light than others because of the rays having been bent. In the next exposure we will get a picture with the air densities slightly changed, and the light pattern on the film will be changed a little. In this manner the wavy appearance will be recorded and can later be thrown on the screen. It is in this manner that the movement of air around the wing of a plane can be shown, the waviness being due to pressure differences instead of heat differences. The pictures taken were not those of an airplane in motion but were obtained by blowing air at a stationary wing.



An ultra-high speed photograph of an air current issuing from a perforated plate at left and entering a constricting nozzle. Note expansion and vortices after current has passed the nozzle.

In addition to the value of such high speed pictures for the purposes of study of design, and for research, they also have a great value for instruction. It is possible to take pictures of high speed machines and to show them in the class room so that the student can obtain an exact knowledge of the manner in which the machine functions. It is not only quicker than the descriptive method but it is certain to give only the correct concept to the student. A description in words is easy to misinterpret, or to color, by some preconceived idea of an erroneous nature.

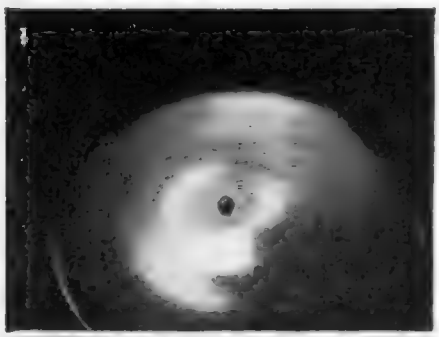
The slow motion picture is the only method for making a permanent record of the behavior of fast moving objects for leisurely study. The nearest thing we have had to this in the past has been the stroboscope. Everyone has seen moving pictures of automobiles in which the wheels appeared to revolve backward, to stand still, or to move forward in a manner wholly inconsistent with the motion of the vehicle to which they were attached. This is a stroboscopic effect. If between two exposures the wheel has so turned that there is a spoke in every position where one was previously, the wheel appears to have stood still. If they barely fail to reach this position the wheel appears to be turning backward. The eye unconsciously assumes that the spoke nearest to the place where it previously saw a spoke is the same spoke whereas, in actual fact, several spokes may have passed this position between exposures.

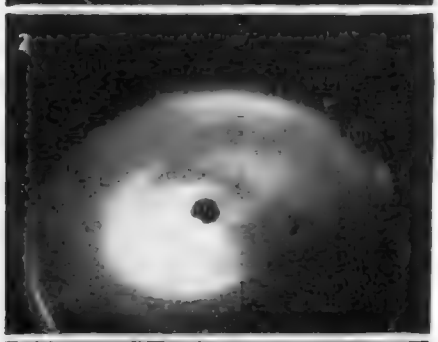
This effect (*Continued on page* 167)

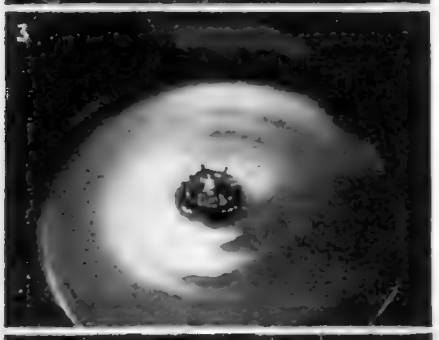
The Life History of a Splash

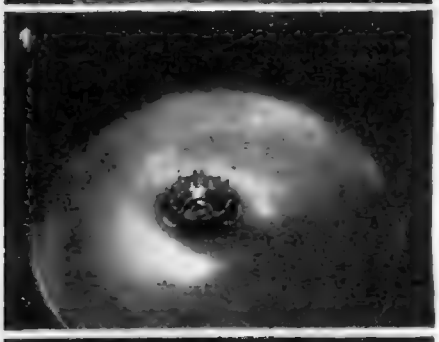
From Observation Made of the Splashes Which Semi-Solids Make We Are Able to Demonstrate the Action Which, According to One Theory, Formed the Craters on the Moon

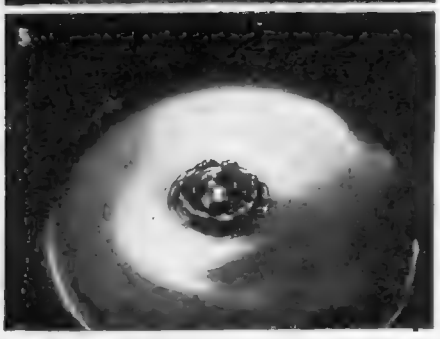
By W. Gorell, Jr.











THE craters of the moon have always excited the curiosity and fired the imagination of the scientific world. How were they formed? Were they due to volcanic action or are they the visible evidences of the collisions of innumerable meteors with that satellite while still in a plastic state?

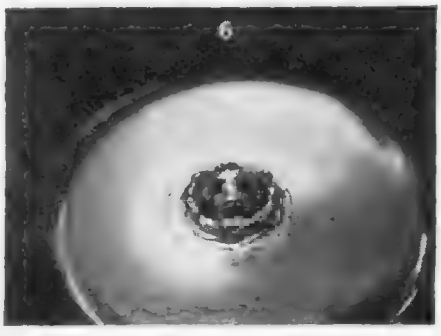
The theory which has gained the most supporters is the one that attributes the origin of these mystifying cone-shaped cavities to the chance meeting of the silvery orb and sundry hurtling bodies in space. It has been claimed that each crater presents the same formation that would result from the impact of a falling body.

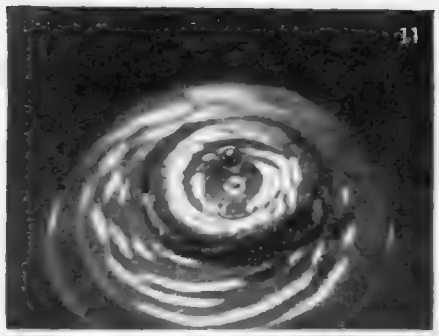
We ourselves cannot verify this assumption by reproducing the same conditions that prevail when a meteor strikes the earth. But we can artificially manufacture in the laboratory miniature meteors which will simulate the genuine closely enough for our purposes. Semi-solids and liquids will be used for our tests and a special camera will photograph the action at different intervals of time so that we can study any particular phase of the experiment at our leisure.

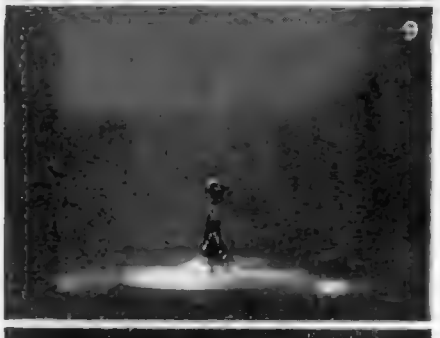
The experimental production of craters similar to those found on the moon has often been attempted by research workers. Unfortunately the successive actions take place so swiftly that it is usually impossible to study any particular phase of the series, or even to form a definite opinion of the exact order in which the actions occur.

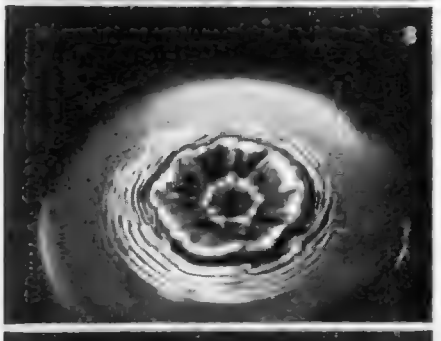
The phenomena that take place too fast for the eye and for the shutter of a camera may often be investigated by using the proper electric spark for illumination. Many are familiar with the "shadowgraphs" of bullets in flight made by means of a highly damped discharge from a condenser.

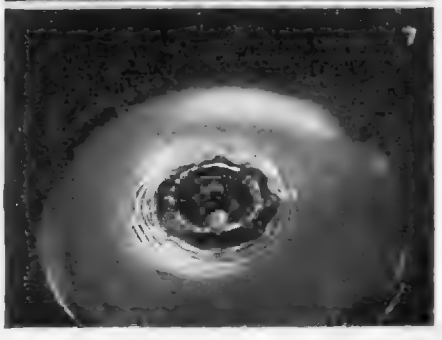
Exposures of less than a two-millionth of a second are by no means uncommon, an interval which would be very difficult to duplicate with a mechanical shutter. (*Cont'd on page* 173)











Aerial Bullets Will Decide

The U.S. Air Corps Is the Only Air Corps in the World Which Now Has Available Powerful Attack Planes Mounting Six Browning Machine Guns Per Plane

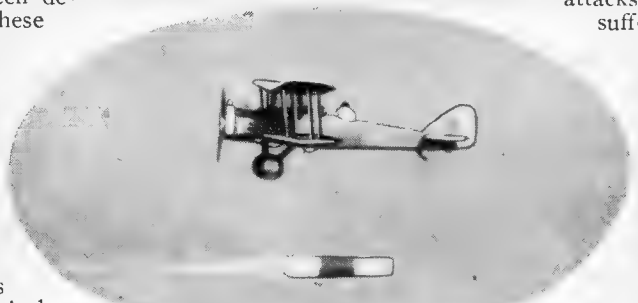
This aerial gun, a marvel of ballistical science, can pour forth 1200 bullets per minute at the maximum rate of fire.

SAMLAND'S modern aerial gunners talk defiance to foes with showers of bullets from skyway machine guns that belch leaden missiles like raindrops fall in a thunder storm.

Frequently you have heard libel against the American Air Corps broadcast by the gossips and amateur critics. They charge our Federal system of air defense and attack as being rather antediluvian. Like most idle talk these rumors are spun from pure fiction.

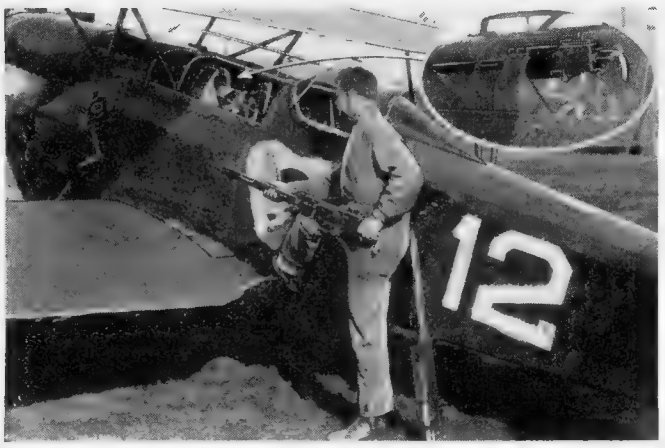
Jot this down on your diary of new facts and underscore it so you will not forget its importance. The U. S. Air Corps leads the flying world in the development of attack planes. It is the only air corps extant which now has available powerful attack planes in which six Browning machine guns are mounted per plane. The pilot and two gunners per plane operate this group of rapid-fire aerial guns which can vomit a maximum of 6,000 bullets per minute on enemy ground forces.

Never in the history of warfare has a more stealthy and annihilative system of attack been devised. A squadron of 28 of these planes, which have peak cruising speeds of 150 miles per hour when flying from 150 to 200 feet above the ground, can utilize woodlands, hills and mountains as screens to conceal its approach from large units of ground foes. It is true that the enemy will hear the drones and echoes of the approaching planes, but unless they are reinforced with aeronautical scouts they will be unable to determine definitely from what direction the aircraft are approaching and whether they are friends or enemies.

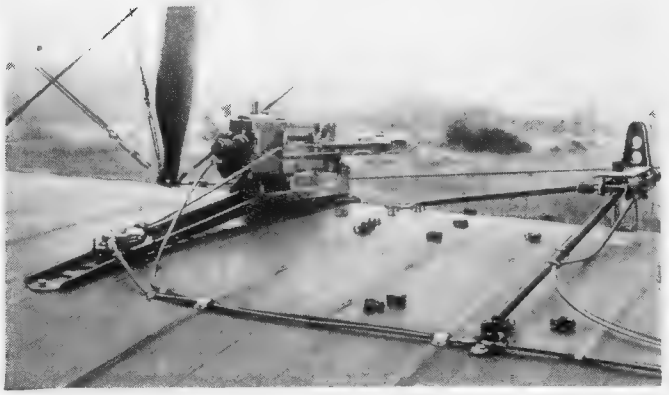


Aerial gunnery practice with a towed target used to simulate an enemy plane.

Suddenly the planes in formidable battle formation sweep into view over the protecting woods or hills, spitting a rainfall of lead as their introduction. Stupendous casualties result where enemy infantry, artillery or cavalry are entrapped on the ground subject to such air attacks. The attacking air force also suffers large losses in such daring sorties, but the punishment which it peddles is much greater than which it receives. According to the revised doctrines of modern warfare, such air losses are justified if they sow correspondingly greater destruction than they reap.



Installing a modern machine gun in the cockpit of an army pursuit plane. Inset—the gun in position.



A 30-calibre Browning machine-gun mounted on the wing of a U.S. Army airplane.

The Lewis machine gun, historic in the development of Uncle Sam's attacks and defenses by air, has been replaced as standard equipment on fighting planes by the more efficient Browning gun. The Lewis gun is simple in operation, is easy to adjust and repair in the air, but it has always been handicapped by the fact that it could never be synchronized "to shoot through the propeller," as the popular expression goes.

The Browning gun, so the story goes, possesses all the advantageous features of the Lewis gun, and in addition is synchronized to shoot through the propeller. Research experimenters met with considerable difficulty in the development of a streamlined magazine for this gun but even that riddle was solved eventually. The guns in the war planes operating at high speeds are exposed to terrific wind blasts; hence the need for the streamlined design of magazines.

What has been said previously is true with one exception —that no machine gun whatsoever is actually synchronized to shoot through the aircraft propeller. The real fact of the matter is that the machine gun is synchronized so that it will not vomit forth its rain of lead when one of the blades of the propeller is in the line of fire. This refusal of the gun to "sing its song" under such conditions is governed automatically. The pilot can press the trigger of the gun which is mounted on his flight control stick, but the gun will not fire until the propeller blade moves enough to facilitate an unobstructed line of fire.

and Bombs the Next War

By Gene Day

Bombing practice, using the ice in a river as a target. Two bombs are shown just after they have left the plane.

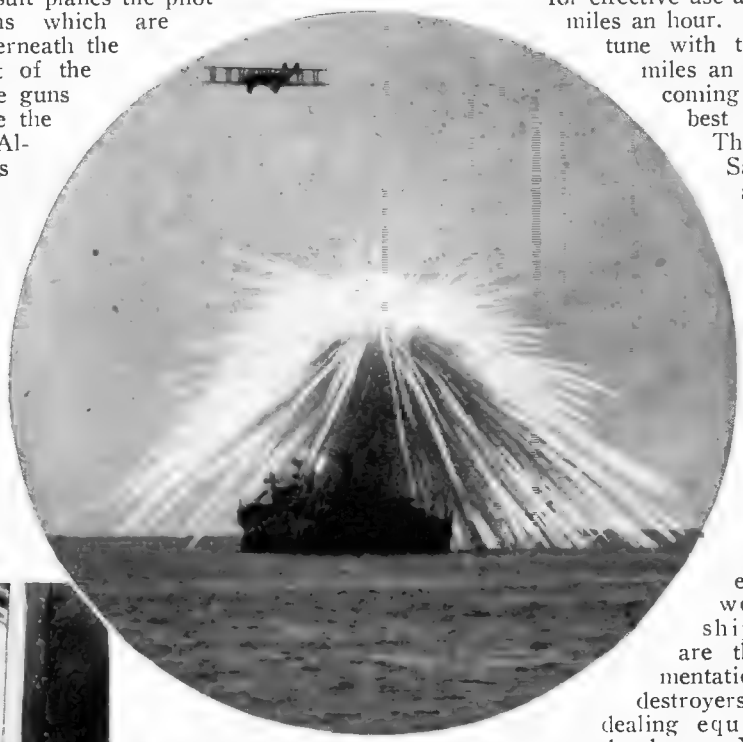
The new Browning machine gun is a marvel of ballistical science. It is an aircooled weapon, being skeletonized with the bolt machined out. Under ordinary firing conditions, it spits bullets at the rate of 850 to 900 a minute, while it can be stepped up to shoot 1,200 leaden charges a minute, with a fast firing rate of 1,000 shots being rather traditional for this weapon.

In the small single seat pursuit planes the pilot operates two machine guns which are mounted in front of him underneath the cowling in the forward part of the cockpit. Usually one of these guns is a .30 calibre weapon while the other is a .50 calibre affair. Although a .30 calibre bullet is usually adequate to disable the enemy plane, a .50 calibre gun is also desirable for emergency use because of its greater range. The maximum effective range of the latter gun is about 2,500 feet, while that of the former is approximately 1,400 feet under aerial warfare conditions.

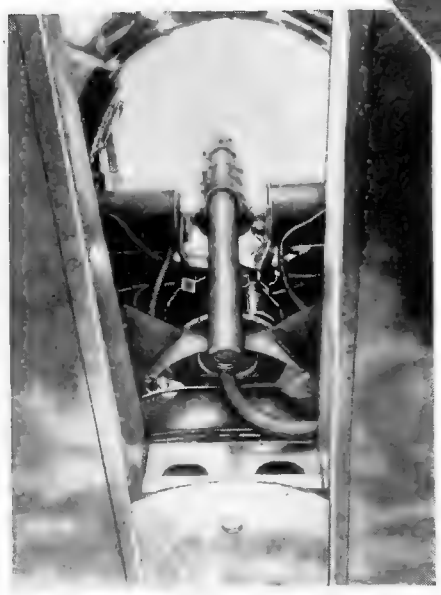
Both the observation and attack planes have twin machine guns on flexible mounts in the rear cockpit which are operated by skilled aerial gunners. New types of mounts are being devised and tested by the Government research engineers, as the flexible ones now in use are not entirely satisfactory because they were originated primarily for effective use at speeds of from 80 to 90 miles an hour. Logically, they are not in tune with the plane speeds of 150 miles an hour, which are now becoming proverbial among the best of the new war planes.

The target practice of Uncle Sam's military birdmen is as accurate a simulation as may be of the bombing and gunnery tactics of actual conflict along the skyways. It consists of diving and shooting at targets on the ground and fabric sleeves towed behind other planes as well as low and high altitude bombing.

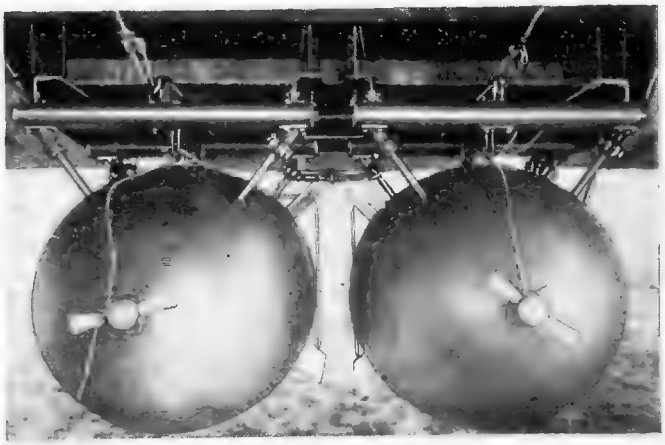
Although the machine guns mounted in attack planes are infallible harbingers of large enemy losses, the major weapons of these "warships of the upper air" are the light 25-pound fragmentation bombs. Ten of these destroyers are carried as death-dealing equipment in each of the attack planes. You can gain some idea of the destructiveness of one of these bombs by the fact that it contains among other explosives four pounds of T N T. The machine guns, in the parlance of the army fliers, are used for "mopping up," supplementary to the bomb-dropping activities. (*Continued on page* 175)



Bombing U.S.S. Alabama. A 100-pound phosphorus bomb has just exploded over the masthead of the target ship. Phosphorus bombs are used to produce a smoke screen, and not to do damage. Such bombs do not explode on contact; they are set off by a time fuse set according to the height of the plane, so that the missile will explode just over the target.



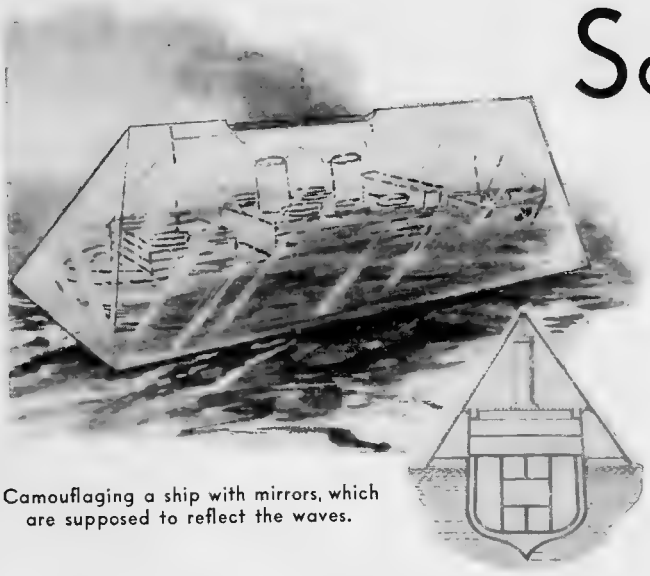
Above—Bottom view of a bombing sight, as installed in the nose of a Martin Type C-2 bomber.



Right—Two 1100-pound demolition bombs loaded on the undercarriage of a Martin bomber, ready to take to the air. The little propellers on the noses of the bombs, by turning as the bomb falls through the air, release the firing pins so that the bombs explode on contact.

Some Curious War Inventions

By Charles W. Revise
Patent Attorney



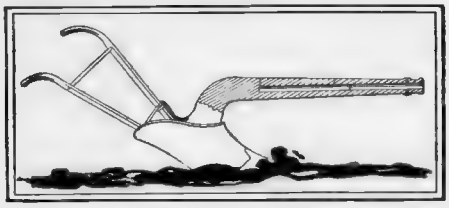
Camouflaging a ship with mirrors, which are supposed to reflect the waves.

THE fairy tales of Aladdin and his wonderful lamp and the dreams of Jules Verne still make interesting reading. But they have been far surpassed by the actual accomplishments of the inventor. He has converted the impossible into the possible and the wholly improbable into everyday actuality. His genius has been responsible for the ocean liner, the automobile, the airplane, the telegraph, the telephone, the radio and the television, whereby time and distance has been well nigh annihilated. Because of his efforts, the average workman of today has an attractive home, electric light, hot and cold water, an automobile, a radio and a telephone.

It is not surprising, therefore, that the public never quite lost the hope during the Great War that the conflict would be brought to a victorious termination over night by some marvelous new scheme springing full-fledged from a single brain. And every one having the soul of an inventor hoped that his would be that single brain. As a result, the Board of Inventions, created by our government to examine the devices submitted by would-be inventors, was swamped by over a hundred thousand alleged inventions. The number of suggestions that succeeded in passing the acid test of practicability were disappointingly small. The reason has been advanced that the art of war is so old and its development under the stress of necessity has been so complete that the ordinary untrained inventor is incapable of making a valuable contribution.*

Strange as it may seem, the Patent Office has granted patents on many devices that obviously could not meet the tests laid down by the Board of Inventions. In fact, a considerable number of them seem bizarre and preposterous. The reason is that the Patent Office will not ordinarily reject an application for a patent merely because the device looks silly. Experience has taught the Patent Examiners that there is a chance in a thousand that a foolish or silly looking affair may be worth something. On account of that one chance, it would be unjust to deny the applicant a patent. The justice of this stand is seen from the fact that many inventions that are now considered basic were ridiculed when first suggested. It will be remembered that the steamboat was for many years known as Fulton's Folly and that the telephone was considered a childish toy.

The policy of the Patent Office to grant patents on new inventions that appear to have little practical value has resulted in a large number of curious inventions covering almost every field of human endeavor. As examples may be mentioned the following:



A plough which is also a machine gun.

(1) Tape worm trap.

(2) Device for pressing trousers while they are being worn.

(3) Lady's skirt that can be converted into an umbrella on a moment's notice.

(4) Device to utilize a person's breath for warming his feet.

(5) Typewriter that writes in Chinese.

(6) Cradle that automatically lulls a baby to sleep and stops rocking when the baby stops crying.

(7) Device that throws a person out of bed in order to wake him.

(8) Combined grocer's package, grater, slicer and mice and fly trap.

(9) Device that automatically draws a blanket over a sleeper when the temperature drops.

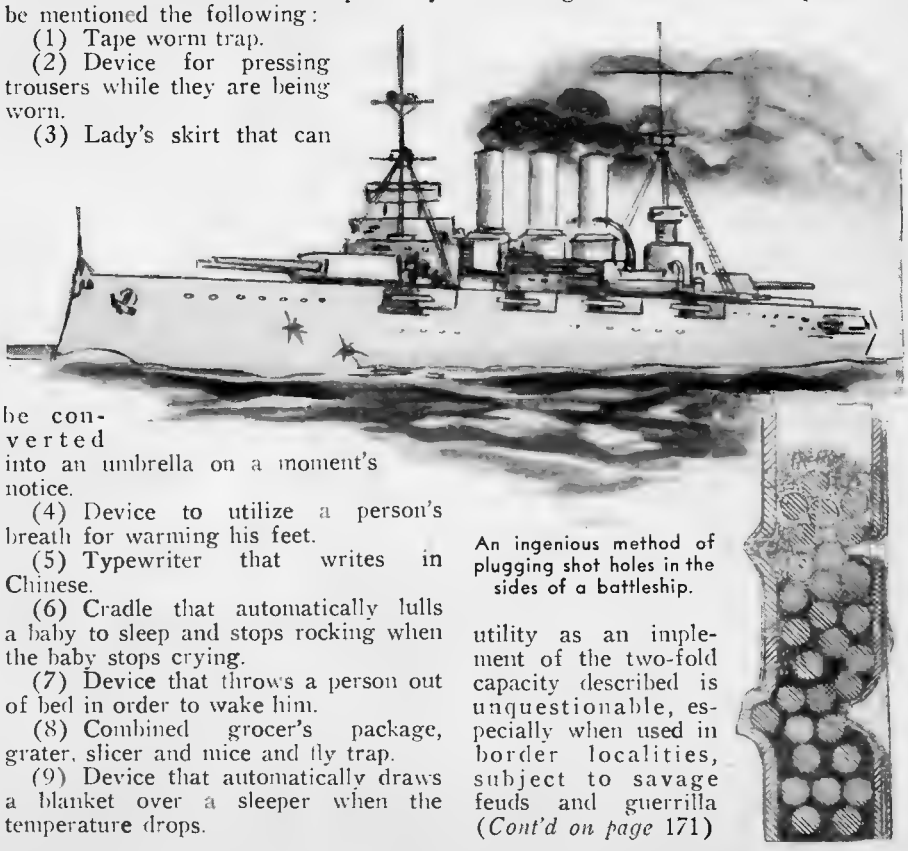
(10) A golf ball that cannot be lost.

(11) Device for planting hair into the scalp of a bald headed man.

(12) Hat that automatically tips itself when the wearer meets a lady of his acquaintance.

In the remainder of this article will be described several curious patented inventions relating to war implements that have caused considerable amusement to all who have seen them. The patent numbers are given in each case so that the reader may secure copies from the Patent Office. Such copies may be obtained at a cost of ten cents each.

The first patent of interest is that of French and Fancher, No. 35,600, granted during the second year of the Civil War, for a combined plow and gun. To quote the patentees, "The object of our invention is to produce a plow, equal if not superior, in point of strength and lightness to that implement as ordinarily made, and at the same time to combine in its construction the elements of light ordnance, so that when the occasion offers it may do valuable service in the capacity of both implements. As a piece of light ordnance its capacity may vary from a projectile of one to three pounds weight without rendering it cumbersome as a plow. Its utility as an implement of the two-fold capacity described is unquestionable, especially when used in border localities, subject to savage feuds and guerrilla



An ingenious method of plugging shot holes in the sides of a battleship.

(*Cont'd on page* 171)

*See Dr. Rossman's article entitled "War and Invention," published in the January, 1931, issue of the American Journal of Sociology.

A typical Mississippi flood scene. The arrows point to weak spots in the levee.

The Unseen Menace of Mississippi Flood Control

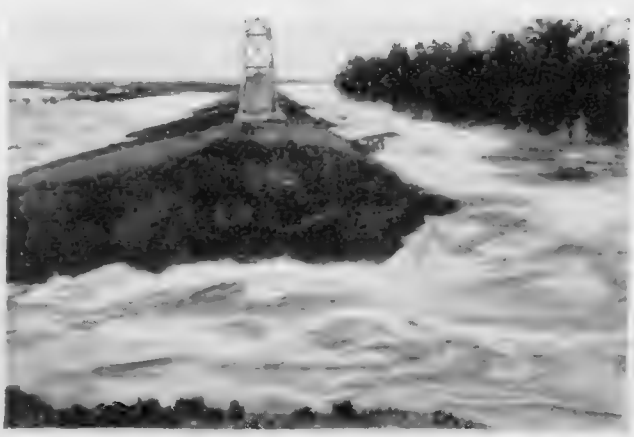
We've Dammed Him and Sand-Bagged Him. We've Stoned His Banks and Bed. And Now That We Have a Plan for Curbing His Turbulence, We Begin to Fear the Protection Will Cost Us Not Only Money but the Fertility of the Soil We are Trying to Protect. That Is the Problem Presented by the Father of Waters, the Greatest River in the World

By Murray Godwin

"THAT OL' DAYVIL SEA" has nothing on the Mississippi when it comes to running cantankerously contrary to the desires of men.

For more than a hundred years the people of the Mississippi Valley have been trying to wrangle the Father of Waters into hitching up nicely with their wishes and needs. They've wanted him to serve them as an avenue of commerce, and they've wanted him to be safe. For years and years they've fought and hoped for these two objects. And now, when comprehensive action has been taken (following on the heels of the great flood of 1927) comes the depressing afterthought—the suspicion that in making the Mississippi safe they will progressively reduce the value of the wealth which has fed the big river's commerce, and which has formed the chief reason for the development of the great program of protecting its raging floods!

Flood waters boiling through a break in the levee.



That's the Mississippi Dilemma—and it's some dilemma, you will admit. You see, first of all, people settled on the bottom lands of the valley because these lands were extraordinarily fertile, and also because the river offered the cheapest and easiest means available for getting crops to market. The reason for the fertility of the bottom lands is that they were built up, through the ages, from fine silt, scoured by the river from the soils through which it flowed from its far source, and deposited, as the stream widened and slowed, along its shores. The extent of this building process can be comprehended, after a fashion, when one knows that the Gulf Stream of Mexico once washed the present site of

Laying concrete mattresses from barges to prevent undercutting or erosion of the river banks.

Cairo, Illinois, where the Ohio now adds its waters to the flood. So, for a thousand miles the Mississippi Valley is actually an alluvial plain, the largest area of the richest soil in the land.

Here and there, at strategic points along the great valley, there grew up river towns to handle the flow of the agricultural and natural wealth for the down-river trade, and to serve as concentration centers for the goods brought into the valley by way of New Orleans. The latter city, founded for the sake of commerce on soil deposited a hundred miles from the river's mouth, expanded so swiftly that today it is second only to New York in foreign trade, and its annual tonnage totals in value no less than nine hundred million dollars.

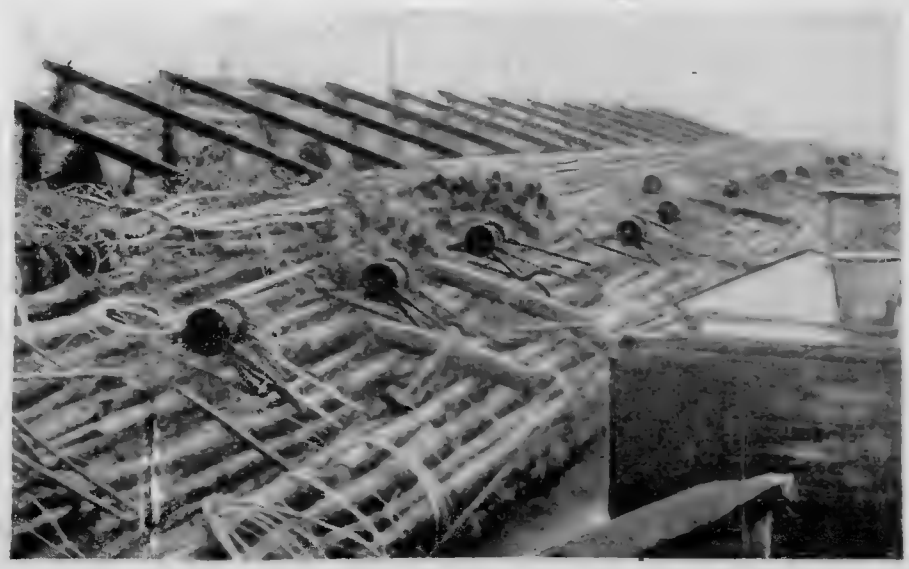
Now, the Mississippi is not only the greatest river in the world, but the greatest and most enveloping system of drainage and inland water transport. As our country is divided today, the main stream of the Father of Waters is fed by streams stretching into thirty-one states. One has to go but a little way, as today's distances are reckoned, west of New York, east of Portland (Oregon), or south of Winnipeg (Canada), in order to find water flowing toward New Orleans.

All in all, not less than forty percent of the country's total area sends its surplus water, at all times of the year, down the great flowing highway leading to the Gulf of Mexico.

At *all* times of the year—that's the point. And in the Spring there is altogether too much water for the river to hold. In the far north—in. Wyoming, Canada, Minnesota, Pennsylvania, New York—the snows are melting and torrents are rushing down a thousand slopes. And here and elsewhere it often happens that the countryside is fairly floating in heavy spring rains. Left comfortably to itself in its natural state, the Father of Waters used to expand at such times until its flow covered a territory of more than thirty thousand square miles! Today its volume of flow, according to modern instruments, leaps from seventy-one thousand cubic feet per second below the Ohio, and 103,000 cubic feet per second below the Arkansas, to a maximum flood discharge in the main channel of 2,000,000 cubic feet per second! The lateral extent of the alluvial soil in the lower valley shows that the great river in flood time once spread itself out to a width of fifty miles! In modern times the normal depth of the stream is sixty to a hundred feet at New Orleans, but in flood time the city lies as much as twenty feet below the level of the turbid waters. The energy annually expended in flood amounts to 60,000,000 horsepower, and annually the flood waters carry 300,000 cubic yards of earth from the lower valley into the Gulf!

In the old days, when Louisiana was a fascinating mixture of French and Spanish masters and merchants, and negro slaves, a respectable system of levee protection had already been built up against the river in flood time. As population increased all along the lower valley, and towns sprang up and grew into cities, the need for protection was met by levee systems flanking not only the main stream but its larger tributaries. These systems logically developed into more elaborate and better coordinated ones, supported by a combine of State-directed levee districts, as the territories increased in population and material wealth. From 1882 on, the Federal government took an active part in developing and maintaining levee protection, and up to 1926 had borne thirty per cent of the cost, as compared with sixty-three per cent borne by the local authorities and the States.

Meanwhile the active commercial phase of river development was going on apace, for the increase in river traffic demanded deeper and better channels



Great mats of young willows and cottonwoods being woven for revetting work.

for the larger boats required to transport the immense and progressively growing quantities of goods. A regular river improvement service was established to free the stream from debris and snags and to dredge out the shoal places which built up when the river was on a rampage. Often work was performed which was designed not only to protect the levees against the river's attack in flood, but also to prevent erosion, the product of which might be carried away by the torrent and redeposited where it would impede navigation.

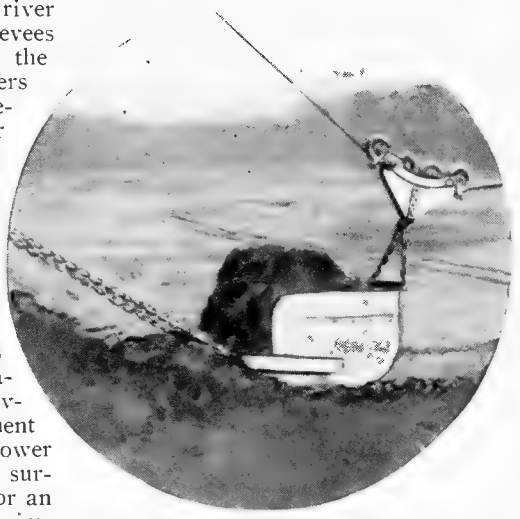
Levee protection has not always proved to be a blessing in such cases. For, first, it has encouraged heavy settlement on the rich lands close to the river bank, and, second, it has raised the flood height of the river by confining it in a narrowed bed. The result has been that a levee failure has always let in an inordinately large and fierce flood of water, and has let it in to do vastly more damage than would have been the case had the river been left more nearly in its natural state.

Moreover, there has been an unhappy but inescapable competition in levee building. River towns have become more fearful of flood as their material wealth and the number of their industries have increased. The tendency of the prosperous communities has been to dyke the river to the limit on this account, thus forcing similar action on folk located farther down the valley, and thus continually working to build up the ferocity of the river in flood. In consequence, the catastrophes caused by levee failure have tended to increase in extent. Nor has their frequency decreased by much, if any, since there is a well-defined point of efficiency in the height to which levees can be safely built, and beyond this point they become increasingly insecure. The alluvial soil of the valley is the only practical levee material, because material brought from a distance would make the cost of extensive protection impossible to meet. But this soil, effective in a reasonable degree if used only in structures of from twenty to thirty feet high, cannot be built up beyond this height without squeezing out the material at its base, and weakening the protective value. Its porous nature will not stand the strain.

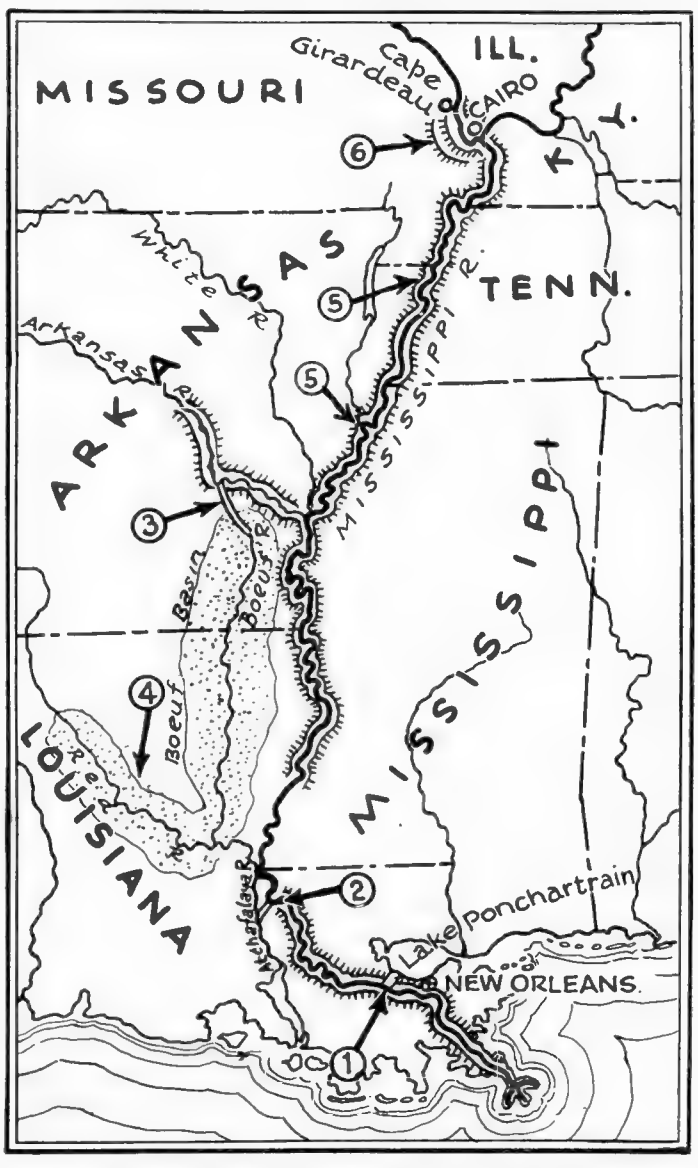
All in all, the elaborate system of levee protection has served mostly to protect the valley only during ordinary floods. When simultaneous freshets from its tributaries have swollen the river to the heights most feared, the levees have developed crevasses under the attack and have let the waters through to inundate the areas beyond. Thus, in 1927, when Mother Nature synchronized her downpours to most disastrous extremes, nearly two hundred lives were lost, 700,000 people were made homeless for a month, and an actual property loss was inflicted of $236,334,414.06!

If the United States can make it so, that was the Mississippi's last rampage. Shortly after the catastrophe of 1927, the Federal Government called on the War Department for a plan of flood control in the lower valley, and the plan, after careful survey, was duly presented. It calls for an expenditure on a system of levee improvements, spillways, and bank protection, of about $310,000,000, with completion in ten years and maintenance thereafter.

The War Department's plan, now in process of execution, aims to protect the lower alluvial valley from the greatest flood predicted as possible, which would reach heights even greater than the most violent floods of modern times—those of 1882, 1912, and 1927.



The scoop of a drag-line levee-making machine, scraping up soil to increase the height of the levee.



Map of the lower Mississippi Valley, showing location of various flood control plans which are projected or in process of being carried out.

The attempt to control the river by confining it has been given up as a bad job. At ordinary flood stages only, the flood waters will be confined within improved levees. Above these stages, the river will escape laterally through "safety valves," and find its way along natural canals bordered by high land to points where it will empty, as the river lowers, into the main stream. Thus, dangerous pressures will be relieved at the cost of inundating a minimum of territory, most of which is swamp and timber land. Of the cleared land included in the relief floodways, the greater share of it will be workable during from four years out of five, to eleven years out of twelve. Less than a sixth of it will be flooded one year in three.

But while the people of the lower valley will welcome protection against the Father of Waters for a generation at least, there is a question whether, in the long run, the less-protected population in the floodways will not be better off. The Mississippi problem of the future may be that of giving the river back, at intervals, some of its natural freedom to flood the countryside.

All of us know that from times immemorial the richness of the Nile Valley has been closely

(*Continued on page* 167)

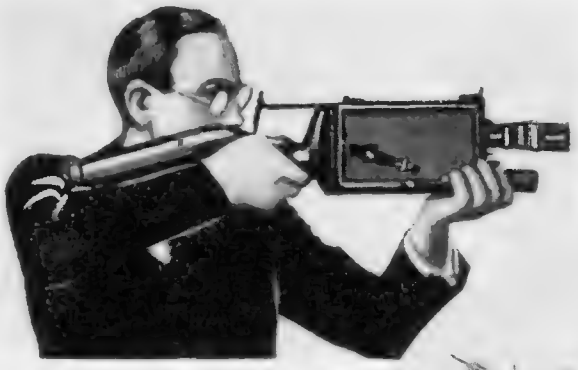
Movie "Machine Gun" Checks Aerial Marksmanship

By Rene Leonhardt

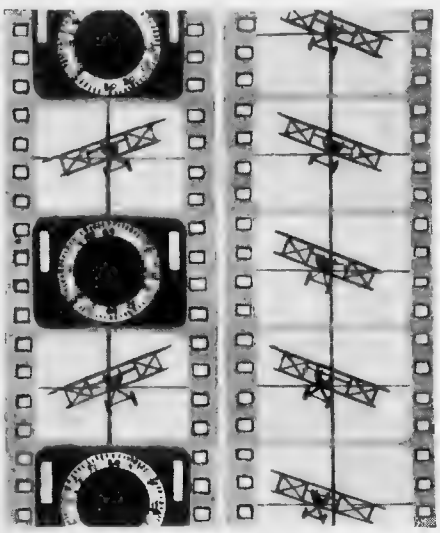
THERE is nothing new under the sun! One hardly ever thinks today of the researches of the French physiologist, Jules Marey, who in his attempt to fix the flight of a bird on moving pictures, invented in the year 1885, a photographic gun which caused a great sensation in scientific circles as well as among the general public.

His primitive apparatus, one of the forerunners of the modern cinematograph, was of a gun-shaped form. In the front of the barrel was the lens, behind, at the back, the photographic plate. When the trigger was pressed, a clockwork made the plate revolve jerkily. In this way portions of the plate came, one after another, into position and remained stationary for a moment. The exposure was simultaneously regulated by an automatic shutter; 12 pictures could be made to the second and the flight of a bird was for the first time obtained upon a plate.

Doubtless, the pictures were not very clear, and showed no details, but nevertheless, they sufficed to give an explanation of the movements of the wings. Marey, however, could not possibly have dreamt that after nearly half a century his idea, once stored away in the lumber room, would be raked out, cast in a new form and be applied to the most modern instruments of war. And yet it is so, as a tour through this year's Aircraft Exhibition in Paris shows.



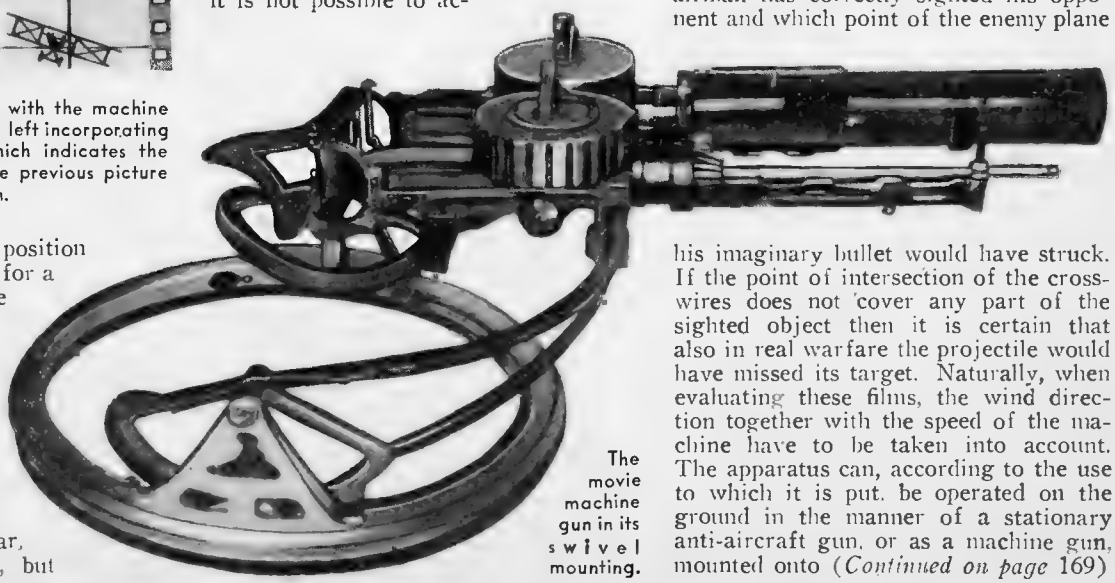
Above—The cinematographic "gun" invented by Professor Jules Marey in 1885. Right—A modern version of the movie "machine gun" as installed in the gunner's cockpit.



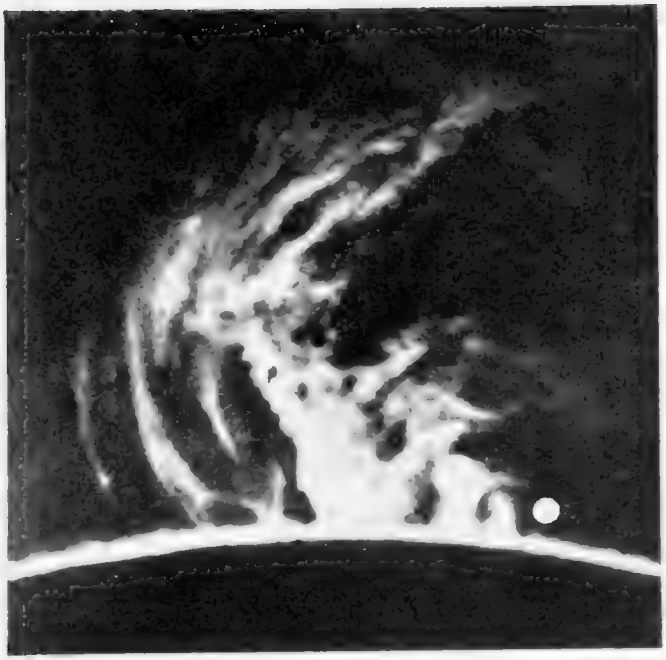
Two samples of film taken with the machine gun movie camera, that at left incorporating views of a clock dial, which indicates the exact moment at which the previous picture was taken.

It is generally known what stress countries today lay on the development of the air forces, but few of us know by what means of modern technique airmen are trained, the fighting qualities of certain machines ascertained and the defence batteries prepared for service. While, on the one hand, it is not possible to actually shoot during air-maneuvres, there exists on the other hand the necessity of training the airmen by reproducing all conditions liable to be met with in a real engagement. For such a purpose we now have the use of the cinematographic machine gun, or as it was originally called, the "Mitrailleuse cinematographique."

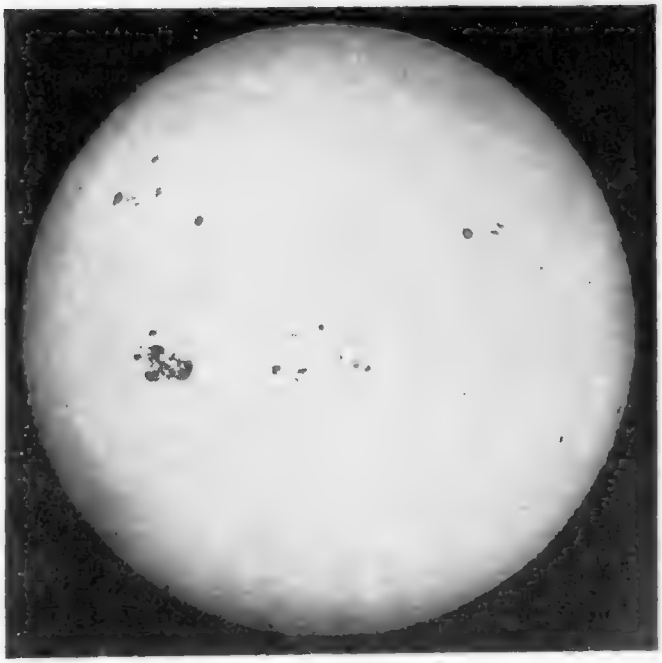
This instrument has outwardly all the appearance of the real machine gun, being operated in exactly the same way and with all attachments, but whereas in the one case a bullet is ejaculated an unexposed film is liberated in the other. Images of cross-wires as well as the object to be observed (in this case an airplane) are projected onto the film. The theoretical axis of the machine gun barrel, or rather of the objective lens, passes through the centre of the cross-wires. As the result of this it is not difficult to see whether the airman has correctly sighted his opponent and which point of the enemy plane his imaginary bullet would have struck. If the point of intersection of the cross-wires does not cover any part of the sighted object then it is certain that also in real warfare the projectile would have missed its target. Naturally, when evaluating these films, the wind direction together with the speed of the machine have to be taken into account. The apparatus can, according to the use to which it is put, be operated on the ground in the manner of a stationary anti-aircraft gun, or as a machine gun, mounted onto (*Continued on page* 169)



The movie machine gun in its swivel mounting.



Solar prominences, as seen during an eclipse. These consist of hot gases rising thousands of miles above the sun's surface. The white dot represents the relative size of the earth.



A photograph of the sun, showing sun spots which are now recognized as being responsible for certain unusual weather and radio conditions here on earth. They are really "holes" in the sun's hot, gaseous atmosphere.

What Makes the Sun Hot?

Scientists Have Ever Wondered About the Sun. What Is the Source of Its Energy? Will It Shine for Ever, or Is It Slowly Dying? In the Following Article Our Astrophysics Editor Discusses Many of the Theories Which Have Been Evolved

By Dr. Donald H. Menzel, Ph.D.
Lick Observatory, Mount Hamilton, California

SUPPOSE in tomorrow's newspapers we should find headlines reading: "SCIENTIST PREDICTS DEATH OF SUN IN 1935!" If the forecast were not a hoax, we should be facing a most serious situation, compared to which other private, national, or international difficulties would be trifling indeed. We shall not try to picture the consternation of a world confronting this problem.

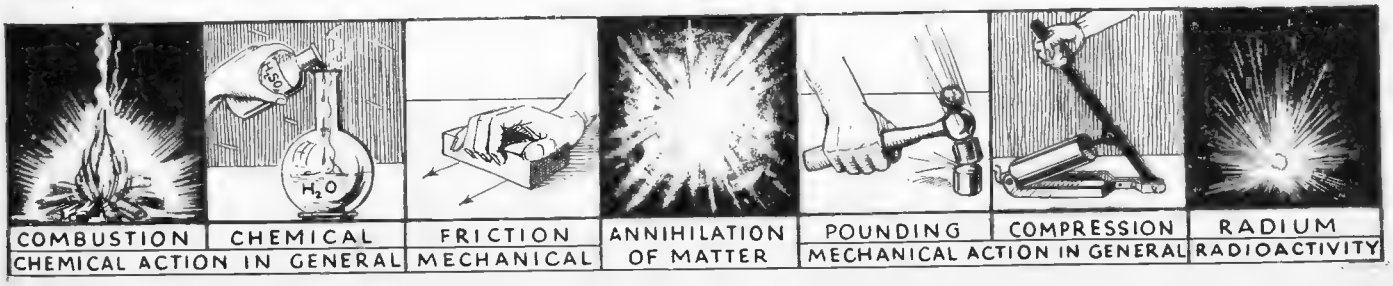
But in reality we all stand face to face with this sort of destiny. The fact that the sun rose this morning, the same as it has for countless mornings in the past, is not of itself a guarantee that it will still shine tomorrow, next week, or centuries hence. The farther we go from our own era, the greater the certainty that some "morning," devoid though the word will be of its usual significance, sunrise will fail to bring its customary sunshine, and that, thenceforth, the earth will be doomed to perpetual night. All nature cries out against the possibility of perpetual motion, and the sun can be no exception to this iron-clad rule of the universe. Since the sun is only finite in size, its store of heat and energy is necessarily limited. Inevitably we are approaching the time when the solar engine will "stall" from want of fuel, and the sun will shine no more.

Absence of daylight, and incidentally, of moonlight, would probably be the most conspicuous loss, but it would scarcely be the most serious. Without its daily bath of sunshine, the earth would rapidly grow colder. The warmth (?) of starlight would be enough to hold the temperature of the terrestrial surface at three or four degrees above absolute zero (minus 273 degrees Centigrade) and radioactive material within the earth might contribute a little additional heat, but in almost no time at all the oceans would be frozen to their depths and we should be in imminent danger of having the atmosphere liquefy, fall like rain, and freeze upon the surface of the earth.

Where would the remaining inhabitants (if any) get their heat to fortify themselves against the encroaching cold? From electricity? Most of the world's electric power comes from falling water; without solar heat, evaporation would stop and rivers would cease to flow even if they did not freeze. The inhabitants might, of course, get their heat from coal, wood, or petroleum, but, in a sense, this is only second-hand

(Continued on page 179)

Below—Various ways of producing heat and light.



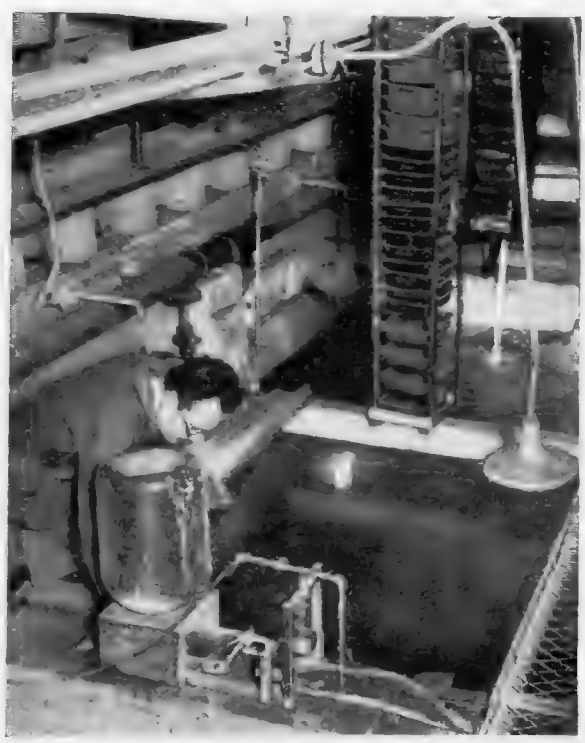
Behind the Scenes in

By Thomas Howley, *Fish Culturist of the New York Aquarium*

A sea horse and, above, sick fish are given ultra-violet ray treatment in the Aquarium laboratory. Right —A shark taking a sucker for a ride! These sucker fish attach themselves to sharks by means of a suction disc on top of their head, and feed on scraps dropped by the shark. Note other fish steering clear of the shark.

GENERALLY speaking, the first place the visitor to New York thinks about is usually the Aquarium. One charming visitor was gazing up into the dome, and, seeing a dark area which, in imagination, suggests a silhouette of a woman's head and shoulders, remarked: "Look. There is the spirit of Jenny Lind!" That was probably a spontaneous expression for the name of Jenny Lind is indelibly associated with this famous old building. But so are the names of Lafayette, Presidents Tyler and Jackson, Daniel Webster, Kossuth, Samuel F. B. Morse, the inventor of the telegraph, and many other celebrities. Perhaps it is this rich historic background which accounts in part for the tremendous interest both Americans and foreigners have in this unusual place.

And when these many visitors return to their homes again their boast is nearly always the same —"I have seen the New York Aquarium!" But this remark is only partly true. The real Aquarium exists behind the tanks and is by far the most interesting part of it. Visitors never see this part of the Aquarium because the public are not permitted to go "behind the scenes," for obvious reasons. But the New York Zoological Society has granted special permission to SCIENCE AND INVENTION to bring its readers on a personally conducted tour behind the tanks, and one of the laboratory scientists is assigned to us as a guide.



Chemicals are added to the tanks to make the water as natural as possible.

And so we enter a little "stage door" which is located right inside of the main rotunda. As we ascend to the top of the stairway an unusual scene is before us. Right below is the first of a long line of huge tanks which run entirely around the circular building. Above, to our left, is another row of smaller tanks following the same circular course of the larger tanks. We are standing on a narrow catwalk which is supported by the walls of the larger tanks, and are thrilled at the thought that but one foot below us are huge June Fish observing us very closely. All of the tanks are open at the top and the rays of brilliant electric light bulbs mixed with the natural daylight enable us to see everything that is going on within them. We can also see right through the glass fronts of the tanks, which are one inch thick, on the other side of which are the crowds watching the fish swim about.

We hear a scream and look back. A keeper is supporting one of the fair members of our party. Investigation reveals that she had placed her hand near one of the fish in the tank nearest her and the fish, leaping partly out of the water, snapped at her hand but, fortunately, the girl was faster than the fish and no harm was done. Our guide cautions us not to place our hands near the tanks, explaining that every time the fish see people walking along the cat-

a World Renowned Aquarium

Do You Know That It Is Possible for Fish to Become Sea-Sick; That the New York Aquarium Sends Specimens to Aquariums the World Over; That It Maintains a Research Laboratory and Doctors Sick Fish? These and Many Other Little Known Facts Are Brought to Light in This Fascinating Article

walk they think it is feeding time and become very excited.

A strange sight greets us at the next bank of tanks. We notice a huge inverted chemical bottle with a device attached to it that intermittently permits several drops of the chemical to fall into the tank. We learn that the chemical is bicarbonate of soda which is used to neutralize the acids thrown off by the fish. Nature takes care of the chemical balance of the water in the native environment of the fish, while in the Aquarium, even though the water is brought from the ocean or lake, whatever the case may be, chemistry has to compensate for deficiencies that are bound to exist. Our guide explains that the addition of chemicals to the tanks has been practised for over a year and is a complete success. Other chemicals are used for other purposes, and the Aquarium research workers are continuing their experimental work in this direction.

We see a man approaching in the uniform of a cook or chef. We are happy to learn that it is feeding day, for this is surely a sight never to be forgotten. He has several metal containers filled with fresh clams, shrimp, beefheart, herring and other fish which he has carefully prepared in the Aquarium kitchen. As he goes along the top of the tanks the water becomes frothy with the excited movements of the fish. They certainly know when the cook comes along!

As we watch him go from tank to tank, dropping in carefully measured portions of just the right kind of food for the various fish, our guide interrupts us a moment to tell an interesting scientific experience. It seems that before the addition of chemicals to the fish tanks the chef used to hold the food in his hand and let the fish munch at it till it was consumed. After the chemicals had been added to the water the fish became very much more active and decidedly vicious. The chef would not dare to hold the food in his hand any longer. We are told that this is a very good indication of the fact that the fish are healthier because of the chemicals.

The guide calls our attention to an old gun port in the nine foot thick wall of the Aquarium, which was formerly old Fort Clinton. As we look through the gun port we have a good view of the bay and notice a fair sized boat moving across the panorama. It is the "Sea Horse," which is operated by the Aquarium for the collection of specimens from nearby waters. It makes about twenty-five trips a year and is now returning with thousands of blackfish, puffers, bluefish, a few sharks, lobsters, crabs and a sea horse or two.

The ship has a huge well running the length and width of the vessel with compartments for different fish. They have been caught with special nets and are being transported back to the Aquarium without injury. We wonder how fish are transported from distant parts of the world and learn that they are shipped in tanks. This calls for another question as to how they are fed *en route*. The guide replies that it is best not to feed them at all while in transit to avoid their becoming seasick.

A group of angel fish which, while very angelic in appearance, are anything but that in disposition. According to Aquarium authorities, they are very vicious.

Can you imagine a fish being seasick! We are assured that they often become seasick when travelling. And they can live for many weeks without food.

Continuing along the catwalk we notice some smaller tanks which are used for hatcheries. Through the cooperation of the U. S. Bureau of Fisheries over 1,000,000 fish are hatched at the Aquarium every year. Many of these fish are shipped to other aquariums in this country and abroad.

But we are anxious to see the water system and our guide beckons us to come through a little door and, following him down the stairway, we find that we have completed the circuit of the Aquarium and are now directly opposite where (*Continued on page* 170)

Above—Mr. Fish in person. No expert has been able to identify this specimen as belonging to any known species. Because of the pronounced resemblance of its head to that of a human being, it was dressed up like this at the Aquarium.

This little penguin, as explained in the text, spends all day looking at himself, thinking he sees another penguin.

Harnessing the Tides

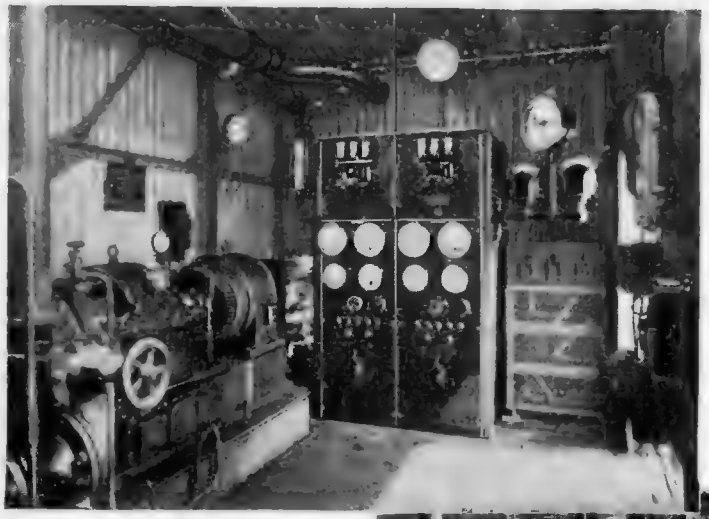
The Problem of Securing Cheap Electrical Power is of Such Widespread Interest That Scores of Schemes Have Been Suggested During Recent Years for Utilizing Tidal Action. Most Have Been Impracticable; But Here Is One Which Has Proved Successful

By Sir Ambrose Fleming, F.R.S.

THE main world problem of today is the supply of power. Everywhere we are replacing animal and human labor by mechanical power and for the purpose of transmission over long distances and ease of transformation into mechanical power of various kinds, as well as into light and heat, the power must be supplied in the form of electric current.

The three main sources of the world's power today are coal, oil and water power. We need not enter here into the possible available world stores of coal and oil. They are certainly large, but when used can never be replaced. On the other hand, the water power represented by high level lakes, waterfalls and rivers is continually being replaced as fast as it is used because the sun raises water continually from the sea, and when its energy as falling water is removed the water itself returns to the sea to be raised again.

So what we call water power is really sun power. Nevertheless the available amount at any time is not unlimited. The latest surveys show that the available water power in the United States is rather more than 38 million horsepower, of which rather over 12 million are already utilized. For Great Britain the figures are very much smaller. One-quarter of a million horsepower is there in use and possibly nearly one million is available.



View of interior of hydro-thermal power station at Avonmouth, showing Laval steam turbine and alternator, and switchboard.

The bottom of the fall tube of the water turbine outside the dock gates, as seen at low tide.

The Ruth steam accumulator.

Now there is another potential source of water power the utilization of which has been for long regarded as possible, and that is due not so much to the sun as to the moon. This power is the tidal power. The moon, by its gravitational attraction, raises two great humps of water on the ocean, and as the earth revolves these humps travel over the surface of the sea, raising what we call high tides on the coasts twice in every 24 hours. There are many complicated phenomena connected with the tides into which we need not enter. To use this tidal power we require to store at high tide a large amount of water in some dock or catchment area, and then at low tide this impounded water can be allowed to run out through water turbines which are coupled to dynamo machines. The current output of these dynamos can then be stored in electric accumulators.

The great disadvantage of this plan is the limited period during the 24 hours during which the store of water can discharge usefully and the variable head of water under which it discharges. Hence the power of the turbine and consequently the speed of the dynamo vary. Also the storage cells cannot be charged with a constant direct current and are therefore worked under unfavorable conditions.

In addition the great capital outlay on storage cells and their rapid depreciation loads down the enterprise financially. Hence such a scheme has never had a wide acceptance. But now a Russian engineer, Mr. Paul Shishkoff, has produced a different and far more economical plan. Instead of using the turbine to drive a direct-current dynamo at constant speed, he employs it to operate a Heenan and Froude water brake by means of which a current of water drawn from a boiler, well lagged to prevent the escape of heat, is pumped back again through the brake to the boiler at a higher temperature.

The water brake consists essentially of a rotor formed on both sides with numerous oval pockets separated from each other by radial vanes. This rotor is surrounded by elements of similar design which are fixed in the casing of the heat generator. Water circulated through the pockets between the rotor and the fixed elements then becomes heated by friction as the rotor revolves, the degree of temperature rise depending upon the amount of water admitted.

As the water circulates through the system it gets hotter and hotter until the boiler or heat reservoir contains hot water with steam above it at a pressure of several hundred pounds per square inch. As the circulating pipe, pump and boiler are thermally insulated the heat goes on accumulating. Moreover the process of generating and storing this heat is not dependent upon very constant speed in the water turbine, as will be presently shown. The water brake forms a cheap and easy method of heating the water of the boiler to steam-raising temperature.

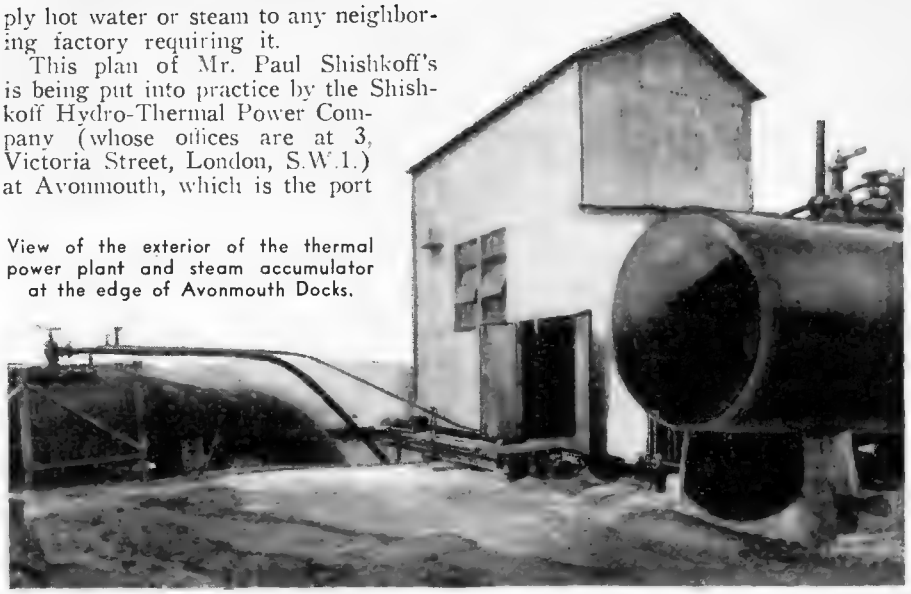
On the turbine shaft above the water brake there is attached the shaft of a dynamo which generates an alternating current of electricity. The steam from the boiler is employed to drive a Laval steam turbine and this again is direct-coupled to another alternator.

The whole process then is as follows: As the tide rises it is allowed to flow into the reservoir, dock or catchment area through dock gates. At high tide these gates are closed and the water impounded. As soon as the outside water has fallen to the point at which the difference of level between the water in the reservoir and that outside is sufficient, a gate in a syphon tube is opened and a water turbine set revolving. The storage of energy as heat in the boiler then begins, and during that time the alternator which is direct coupled to the water turbine will give a supply of electric current for any required purpose.

When the tide begins to rise again the water turbine stops running. The boiler has now in it a store of high temperature water and high pressure steam. This is used to drive a steam turbine and this in turn drives the second alternator. The two periods can be made to overlap so that the two alternators can for a short time be worked in parallel, and then No. 1 dropped out when No. 2 takes over the load.

In this way a practically continuous supply of electric energy is secured from the variable tidal power without the use of any electrical accumulator or storage battery. Moreover, the whole plant can, in addition, be used to supply hot water or steam to any neighboring factory requiring it.

This plan of Mr. Paul Shishkoff's is being put into practice by the Shishkoff Hydro-Thermal Power Company (whose offices are at 3, Victoria Street, London, S.W.1.) at Avonmouth, which is the port of the City of Bristol, England.



View of the exterior of the thermal power plant and steam accumulator at the edge of Avonmouth Docks.

This place was chosen because there are large docks there, the property of the Corporation of Bristol, and the use of one of these was obtained in order to avoid the necessity for constructing any fresh catchment area. Avonmouth lies near the mouth of the river Severn, and the tide there rises about 30 or 40 feet or so above the level of low water.

The tidal range is such that the difference of level between the water in the dock, impounded at high tide, and the outer level is sufficient to enable the turbine to be worked about 8 hours out of 12½. At Avonmouth the dock used is so large in volume, relatively to the amount of water passing through the turbine, that the level of water in the dock is lowered only nine inches during the working period by the water used. The water is drawn from the dock by means of an iron syphon tube 42 inches in diameter, which bends over the wall of the dock and leads the water down to the water turbine.

A small house, or power station (shown above), was built at the side of the dock outside its gates, and near the level of low tide a simple fixed-guide water turbine, capable of giving up to 280 horsepower, was placed with its shaft vertical, the inlet valve being controlled from the station above.

This turbine, supplied by Boving Ltd., is designed to work with a head of water varying from 12 to 36 feet, and to develop 58 to 280 h.p., according to head, when running at a speed of 500 revolutions per minute, and at a mean efficiency of 84 per cent.

The vertical turbine shaft comes up inside the station and has fixed on the top a Heenan and Froude hydraulic brake capable of absorbing up to 400 horsepower at 500 r.p.m.

Above the brake there is attached a vertical three-phase alternator of 32 kilowatt power made by the English Electric Company. It generates current at 400 volts and 50 cycles frequency.

The arrangement will be understood from the sketch diagram at left. Outside the station is a Ruths steam accumulator or boiler 19 feet 6 inches long and 6 feet in diameter having a capacity of 510 cubic feet. About three quarters (*Continued on page* 178)

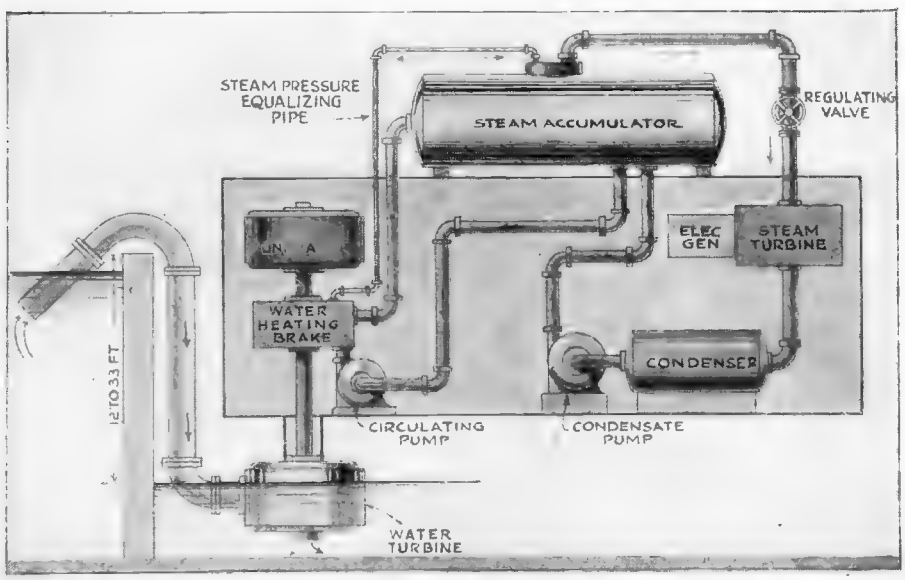
Sir Ambrose Fleming Honored Again

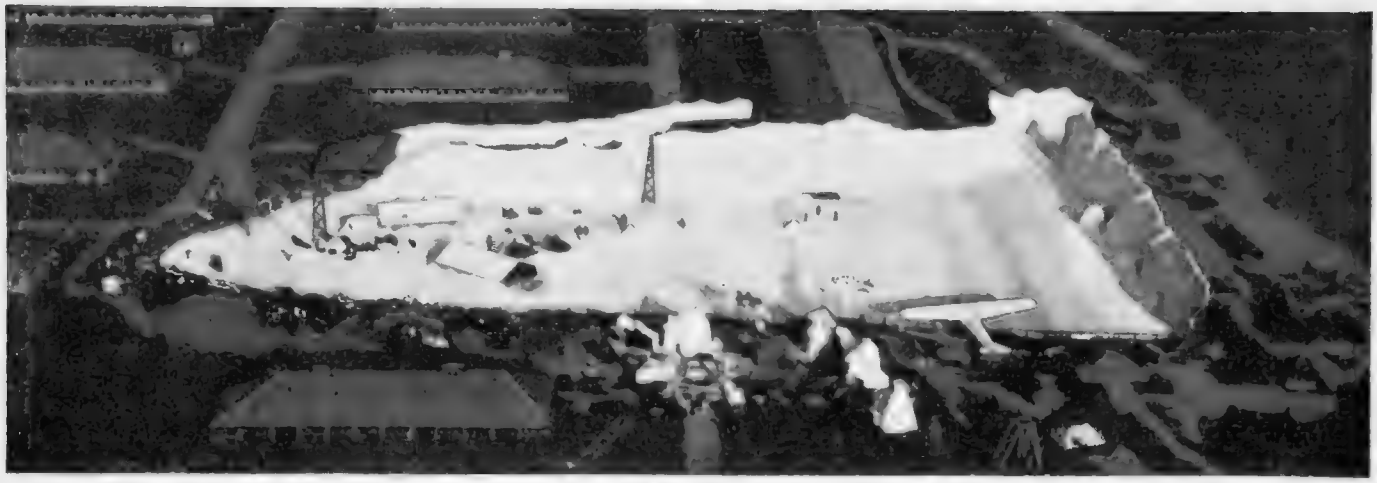
At the Annual General Meeting of the Physical Society of London, held on March 20th at the Imperial College of Science, London, the President, Sir Arthur Eddington, F.R.S., presented to Sir Ambrose Fleming the Duddell Medal.

This Medal is awarded not oftener than once a year to some scientist who has made notable advances in the design or invention of scientific instruments or in other ways assisted the progress of physics.

Sir Ambrose Fleming has been closely connected with the introduction into Great Britain of the telephone, the electric lamp and with wireless telegraphy, and has made important scientific researches and discoveries in connection with them. He has already been the recipient of high honor, such as the Albert Medal and the Faraday Medal.

Diagrammatic sketch showing the process of operation of the Shishkoff system.





An airplane view of the huge outdoor set built at Arcadia, California, which was a counterpart of Byrd's "Little America."

Byrd's "Little America" Reproduced for the Movies

A Giant Set, Three Miles Square, an Exact Replica of the Antarctic Settlement, Was Constructed for the Filming of "Dirigible." 2,500,000 Pounds of Artificial Snow and Enough Lumber to House a Town of 5,000 Inhabitants Were Consumed

By Sterling Gleason

RESIDENTS of Arcadia, California, and other near-by towns, were amazed one summer morning recently to see that during the night snow had fallen on gardens and housetops. Meanwhile, a company of motion picture people, several miles away, was in consternation because a heavy wind during the night had blown away 2,500,000 pounds of artificial snow from a giant set three miles square, which reproduced in exact detail Byrd's "Little America" Antarctic settlement.

Upon the level surface of the U. S. Government balloon school at Arcadia, motion picture technicians had stretched thousands of yards of canvas. Into the whirling blades of a movie "wind machine" they scooped a thousand tons of a glistening white gypsum, which swept across the field and swirled into realistic-looking snowdrifts. Using enough lumber to house a city of 5,000 inhabitants, they built around the edge of the field a white counterpart of Antarctica's great ice-wall. And while the thermometer stood at 110° in the shade, Jack Holt and Ralph Graves, dressed in heavy furs and skin boots, enacted before the sound cameras the rôle of explorers into the icy wastes of the Antarctic.

While the movie men were mimicking Nature with synthetic snowstorms, and manipulating towering plaster-coated "icebergs" that were mounted on movable wheels, others were piloting the great dirigible *Los Angeles* over the skyline of New York. The U. S. Navy had turned (*Continued on page 177*)

The base camp of the expedition, where the party was marooned. The giant plane is a reproduction of a western Air Transport, built in wood.

Filming the rescue. Shooting polar scenes in California with the thermometer at 110° is no pleasant job. Heavy furs and skin boots do not add to the actors' comfort.

World's Super Amusement Center — Radio City —

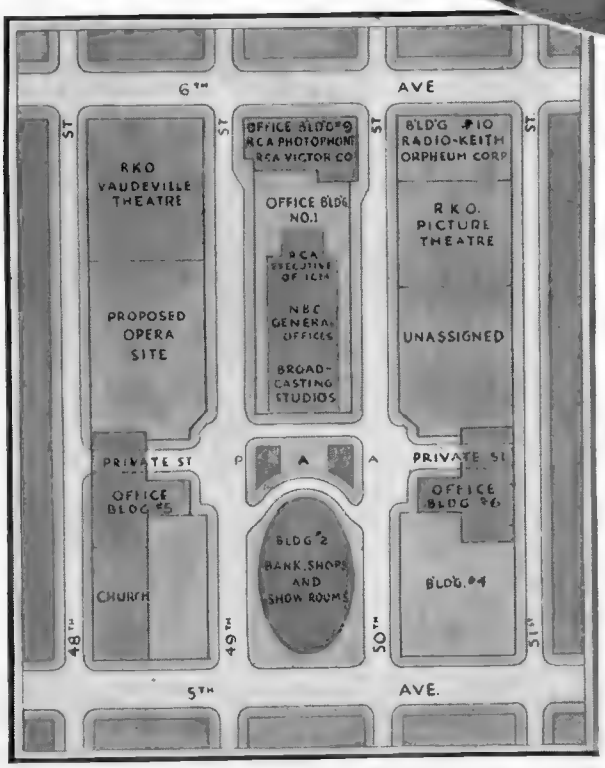
Preliminary Plans and Details of the New Rockefeller $250,000,000 Project Reveal It to Be the Greatest Concentration of Amusement Features in the World

LAST summer it was announced that the National Broadcasting Company, the Radio Corporation of America and Radio-Keith-Orpheum, in association with John D. Rockefeller, Jr., planned to build a gigantic new broadcasting and entertainment center in New York at a cost of $250,000,000. Few concrete details of the scheme were published at the time, nor has much definite information been forthcoming in the interim.

Now, however, plans have a more concrete form. Plans, drawings, and a large plaster model of the entire project were recently exhibited at the offices of the architects in New York. The development, referred to on the plans as "Metropolitan Square," but popularly known as "Radio City," is the largest single unit ever contemplated. The site extends from Fifth to Sixth Avenues, and covers three blocks from 48th to 51st Streets, an area measuring roughly 1150 by 1500 feet.

The central feature will be a 68-story building which will house the executive offices of the R.C.A., R.C.A. Photophone, R.C.A.-Victor Co., and N.B.C., while the lower floors of the 36-story Sixth Avenue extension will accommodate some thirty-six N.B.C. studios, some of which will be three stories high. These studios will be designed and wired with an eye to the requirements of television. Another studio feature will be an adaptation of the revolving stage idea, control rooms being located at the point of intersection of the dividing walls of four studios, so that when a program terminates in one studio the control room may be revolved to face the studio in which the next program is due to start. This will assure minimum delay between one program and the next, and facilitate the change-over of studios. Flanking the central building on either side will be two office buildings, almost identical in design, and each forty-five stories in height.

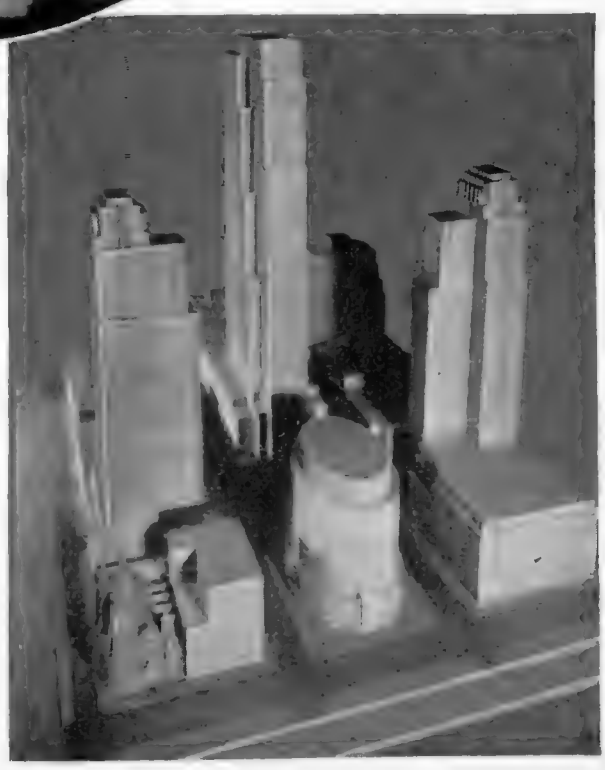
On the corner of Fifth Avenue and 48th Street there is already the Collegiate Church of St. Nicholas, which will remain—very much dwarfed by the surrounding buildings. On the corner of Fifth Avenue and 51st Street there will be a large department store building, but the present tenants of part of the site have a lease extending to 1940 which they refuse to sell, so the new building will be built around this property, with the steelwork so arranged that when the lease expires the entire structure can be completed according to present plans. In the center of the Fifth Avenue side the appearance of the entire site will be relieved by an oval building fourteen stories high. The lower stories of this building, according to present (*Continued on page* 172)



An architect's drawing which reveals dignity and simple beauty. A view looking across the Plaza toward the proposed Opera House.

Left—A group plan of the entire project. By referring to this, the various buildings may easily be identified.

Right — Photograph of a large plaster model of Radio City as it will look when complete. Details of architectural decorations are not shown in the model.



Forests of Stone

The Trees of This Forest Lived Two Hundred Million Years Ago. Down Through the Ages Rock Processes Replaced the Wood, Molecule by Molecule. Thus the Petrified Forests Were Formed

By Sydney E. Helprin

NATIVE southwesterners used to trifle with the credulity of innocent strangers from the east by asserting that the Petrified Forest of Arizona is preserved with such remarkable fidelity that visitors could see petrified birds singing petrified songs in the petrified branches under a blue, petrified sky.

The title "Petrified Collection of Logs" would be more accurate and more descriptive, though perhaps less impressive, than "Petrified Forest," for the fossil trees are actually mere trunks or logs, entirely devoid of branches and leaves. Some of the logs are long, dark, tapering masses merging with the warm sand. They are broken in lines of huge cylindrical chunks with square-cut ends as if sawed by human hands. Countless fossil trunks and segments lie scattered in disorderly confusion over the region, and the ground is strewn abundantly with small chips and broken fragments of petrified wood. The trunks lie prostrate everywhere. All are solid rock, with the rough, dull-lustred form of the outside bark contrasting strikingly with the richly-colored interiors.

Photo Courtesy American Museum of Natural History

A fossil tree from Lincoln County, Idaho, completely changed to opal, yet preserving the woody structure.

In size the trees vary widely. Sometimes the diameter reaches six feet and the length more than a hundred feet, but the average diameter is three or four feet and the average length is about 50 feet.

The beauty and hardness of the fossilized wood, which almost deserves a place among semi-precious gems, nearly caused the Petrified Forest to vanish forever, for tourists carried away the smaller trees and ruthlessly destroyed the larger; vast quantities of petrified wood were cut into paper-weights and similar ornaments; trees, greater in diameter than the height of a man, were polished and sold as table-tops; and one enterprising corporation even proposed to grind the trees to powder as a substitute for emery and for making sandpaper. President Roosevelt put a stop to this vandalism in 1906. He proclaimed that the Petrified Forest was to be a national monument, a wonderland reserved for the people. The forest is now protected by a government custodian and may still be seen by those who answer the call of travel there.

Photo Courtesy Santa Fe Railroad

The Natural Bridge, a great petrified trunk spanning a ravine cut under it by an intermittent stream.

The reservation covers an area of 40½ square miles in Apache County, Arizona, and includes four separate, limited localities called "forests" where the fossil trees are abundant. These localities are named the First, Second, Third, and Rainbow Forests. There are, in addition, two "forests" outside the reservation, known as the Blue and the Black Forests, names which refer to the dominating color of the petrified wood. The individual forests within the reservation occupy areas of one or two square miles and are from two to seven miles apart.

Egypt, California, Idaho, the Bad Lands of the Upper Missouri, and Yellowstone Park have fossil forests of greater or less renown, but the Petrified Forest of Arizona is at once the most beautiful, the most celebrated, and the most ancient of them all. The fossil logs of the Arizona forest are found in rocks of Triassic age. On the basis of the most recent radioactivity calculations, which measure the time involved in Nature's transmutation of uranium to radium, and which place the earth's age at approximately two billion years, the Triassic period began some two hundred million years ago. Two hundred million years ago the trees of the Petrified Forest were alive, and their spreading branches were part of a strange world of the past!

The fossil remains of the Petrified Forest form but one minor variety of the profusion of fossilized plants and animals which geologists have exhumed from rocks of the Triassic period. These fossils indicate that during the Triassic there were humid swamps in which giant rushes and ferns flourished, and in which grew a multitude of repulsive amphibians, creatures which lived both in water and on land. The hot, arid lands were ruled by mighty dinosaurs, the most extraordinary reptiles the world has known: huge beasts, some of them with bird-like feet, running like ostriches in spite of their elephantine bulk. The seas swarmed with innumerable strange molluscs, the ammonites,

Photo Courtesy American Museum of Natural History

Ammonites—molluscs with shells shaped like the ram's horns of the deity Ammon. They swarmed in the seas at the time the trees of the Petrified Forest were still alive.

Logs of solid rock broken by nature into chunks, as if sawed by human hands. The view shows tourists in the Rainbow Forests, one of the four "Forests" within the Petrified Forest National Monument.

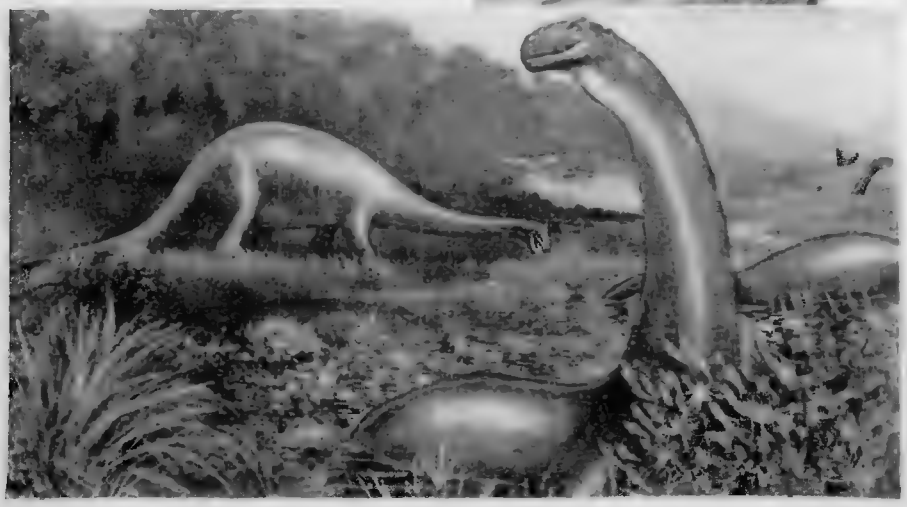
Photo Courtesy Santa Fe Railroad

with shells shaped like the ram's horns of the Egyptian god Ammon. Under the intense heat of the Triassic sun, dinosaur footprints, mud-cracks and rain-prints were dried and preserved in the muds along the shores of inland seas, and, after two hundred million years, have been discovered by geologists. No birds or snakes then existed. A few rare remains of mammals, the most highly organized animals, have been found in Triassic rocks, but they were small and primitive, and gave little promise of their future important destiny. Man, the noblest being of them all, was not fated to appear on the earth for yet many long millions of years.

Microscopic studies of the fossil wood in the Petrified Forest of Arizona, according to a recognized expert, Dr. F. H. Knowlton, prove that the trees belonged to the group "Araucaria," a cone-bearing evergreen tree of the pine family. The Araucaria grows now only in South America and Australasia; it is unknown in the northern hemisphere. What a startling contrast these tall, stately evergreens of the Arizona of Triassic days would bear to the rambling cottonwoods and scrub cedars that grow in the sand-blown gulches of the Petrified Forest today! Pieces of petrified wood, ground down to transparent thinness and examined under the microscope, show the most intimate details of wood-structure preserved in the rock. A section from a living tree could hardly be more perfect than this infinitely ancient petrified wood. The characteristic components of the tissues of the pine family—the tracheids, tubes which transport water through the wood; long rows of pores; medullary rays and growth rings: all are visible under the microscope. Fossil wood from younger petrified forests, as seen in the illustrated specimen from Idaho, often exhibit some of these structures to the naked eye.

These huge beasts, known as Brontosaurus, have been reconstructed from fossil remains discovered in Wyoming. Dinosaurs ruled the earth in the remote era when the trees of the Petrified Forest were alive. Right—A dinosaur walked along a muddy shore in New Jersey 200 million years ago and left these arrow-shaped tracks.

Photo Courtesy American Museum of Natural History



The popular conception of a great living forest suddenly "turned to stone" and "petrified," as Lot's wife was turned to a pillar of salt, or as the three selfish brothers were transformed by the King of the Golden River into three black stones, has been thoroughly discounted by the researches of a number of eminent scientists, among whom are Dr. George P. Merrill of the U. S. National Museum and Professors Lester F. Ward and Frank H. Knowlton of the U. S. Geological Survey.

As a matter of fact, the trees of the Petrified Forest grew at a considerable distance from their present resting place. They were probably uprooted by flood waters of a swiftly-flowing river, and were carried down the stream like lumber in a modern log-drive, the leaves and branches breaking off on the way. Eventually the logs must have accumulated in eddies of the river where the swirling currents arrested the progress of the trees, and where, before they had much opportunity to decay, they were rapidly buried beneath the settling mud, sand, and gravel of the river.

(*Continued on page* 174)

Would You Believe It?

This month, birds, fish, fowl and beast seem to be vieing with one another for first place among unusual beings.

Taking Mr. Penguin for a Walk

LAST year when Sir Hubert Wilkins and his band of adventurers flew to the icy land of the penguins, south of the Antarctic Circle, they tried their best to make friends of these strange birds. They succeeded; but it took two charming visitors to the London Museum to coax Mr. Penguin out for an afternoon promenade. Both visitors and penguin seem to be enjoying the walk.

Rather Close Quarters

HERE'S what one space-shy apartment house dweller, who loved bird and fish, did to keep his pets. He constructed a combination bird cage and fish aquarium. Both species seem to be dwelling in harmony in the latter's natural habitat, water. Just an optical illusion . . . the bird cage is set in the center of the bowl, and extends to an opening in the bottom, through which air penetrates.

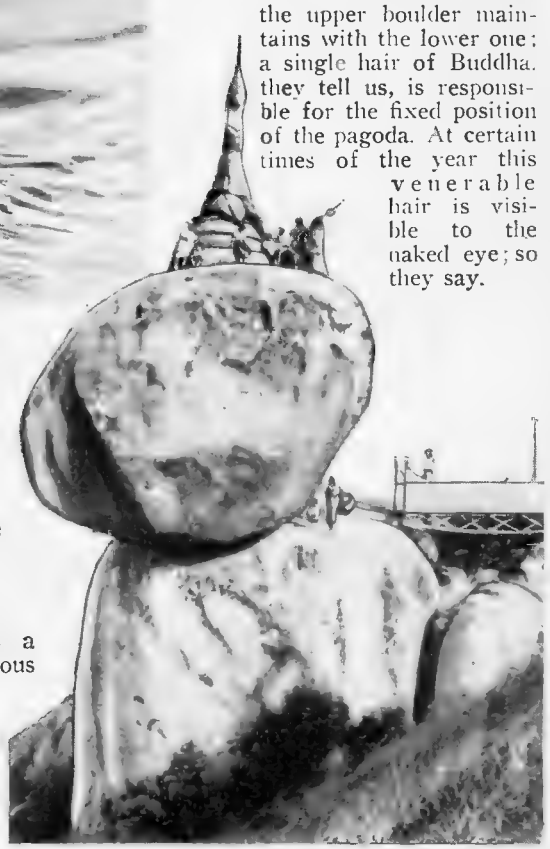
Have you any WOULD YOU BELIEVE IT photographs? We will pay five dollars for every photograph accepted and published on this page. Send them in to the Editor.

A Sea-Faring Rooster

WHENEVER the spirit moves him, this queer specimen of barnyard fowl goes in for a dip in Lake Washington Canal, Seattle, Washington. A puzzled farmer pulled the rooster out of what he considered a watery grave.

Balanced by a Hair of Buddha?

TO our skeptical eyes, the pagoda at Kyaitteyo, Burma, is built upon a huge boulder, balanced on another boulder. We're all wrong, according to the natives of Kelasa Heights, Kyaitteyo, who use this temple for daily worship. The equilibrium of the house of worship is not due to the balance which the upper boulder maintains with the lower one; a single hair of Buddha, they tell us, is responsible for the fixed position of the pagoda. At certain times of the year this venerable hair is visible to the naked eye; so they say.



Equestrian Hostelry

NEAR Berlin, Germany, is a hotel for horses. Luxurious quarters are provided for city residents, rooms are rented by the day or week for transients. The building is three stories high; a balcony runs throughout its length so that the horses can exercise.

Specially trained attendants are provided for the inmates of this horse hotel.

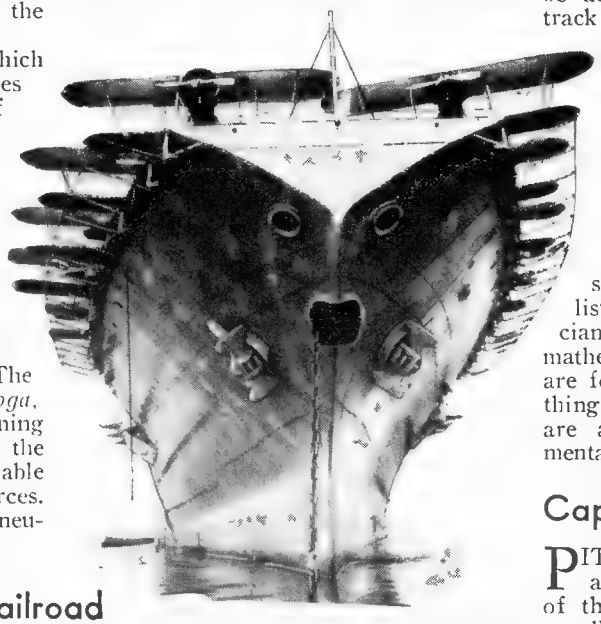
IN THE SPOTLIGHT OF SCIENCE

The U. S. S. Lexington Again to the Rescue

BRISTLING with wings, with wide open eyes and distended mouth, the aircraft carrier *U. S. S. Lexington* faces you, like some long-forgotten monster. The eyes are hawse pipes; the mouth, an opening through which the anchor chain passes and which receives the anchor shank when hoisted; the wings prove to belong to squadrons of planes, lined up on the deck of the huge ship.

This front view of the carrier, which has enacted so many major rôles since its launching, was taken off the coast of Panama, just before the 1931 annnual mimic war of the navy. The four-day struggle took place in the Pacific Ocean. It purported to save the Panama Canal region from the "enemies'" attack. Not a shot was fired, nor a ship sunk; yet all the strategy of actual war was employed. Airplanes, of course, were used in conjunction with battleships. The *Lexington*, together with the *Saratoga*, transported many planes of the winning side to strategic positions along the coast. Here they launched formidable air attacks upon the enemies' forces. Not naval skirmishes, but air maneuvers, decided the contest.

About a year ago, the *U. S. S. Lexington* came into public view also as the first ship to supply electrical power to a city. Tacoma's hydroelectric reservoirs had been depleted by the drouth; the ship was anchored at Tacoma, feeding the city's power lines from her 20,000 kilowatt generators. Suspension of all activity was thus averted.



The Senators' Special Railroad

THAT'S the name that should be given to the monorail line with two cars that runs through the tunnel connecting the Capitol and the Senate Office Building in Wasnington, D. C. It is used by our senators in their travels between these two buildings.

To walk from the Capitol to either the Senate or House of Representative building requires from three to five minutes, depending on what part of the Capitol you set out for. The miniature train makes its run from one to two minutes. It is a one-man affair. The motorman does not complain of being overburdened with traffic.

A similar tunnel connects the House Office Building with the Capitol, but one of these tiny transportation systems has never been installed here. The representatives prefer to walk. Perhaps it is because they are usually younger than their brother lawmakers, and so take more kindly to the exercise.

"Idiot Geniuses" as Victims of One-Track Minds

"IDIOT geniuses" are people who combine mental brilliance in one direction with dullness or actual insanity in others. The existence of such remarkable combinations, according to Dr. MacDonald Critchley of King's College Hospital, London, can be attributed to the completely single track minds which the individuals possess. Lacking the ability to evolve any other ideas or interests, each develops abnormally in the one field in which his mind functions.

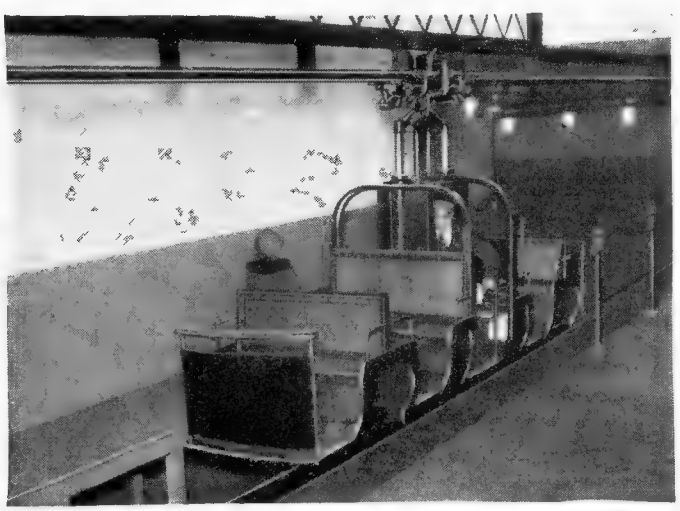
This theory, Dr. Critchley believes, accounts for the remarkable mixtures of idiocy and genius which are met with: Those having supreme technical skill in a single direction; the long list of half-insane artists and musicians; people who perform difficult mathematical calculations although they are fools or idiots at doing almost anything else; and persons whose memories are abnormally good, although other mental powers are way below normal.

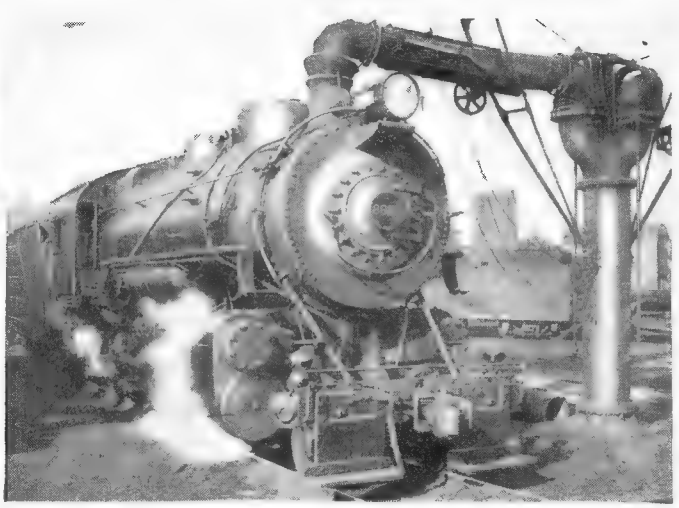
Capturing Locomotive Soot

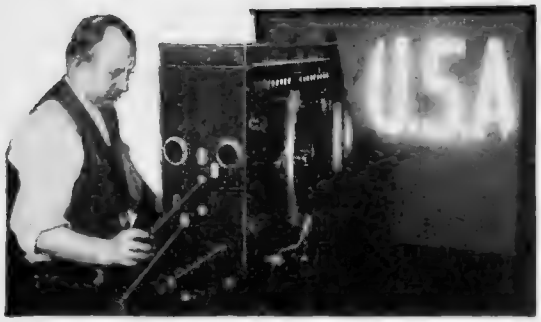
PITTSBURGH has long held its own against all competitors for the title of the Smoky City; Chicago, for the appellation of Windy City. It seems the residents of the latter community were afraid they stood a good chance of wresting Pittsburgh's reputation for themselves. Now they are going in for smoke abatement with a heavy hand.

One of the devices used to keep the city air clean is an engine hood, specially constructed to purify smoke.

As the engine stands in the yards the smoke it produces is fed into the tubes, cleaned, and is expelled through a large stack, free of its soot.







Searchlight Sky Writing Visible for 50 Miles

A NINETY-ONE million candle power searchlight whose beams can be seen for fifty miles has been constructed by Alfred Gauthier, an Alsatian inventor residing in New York. The advertising matter, or other letters projected into the sky, are visible for miles around, the inventor claims. They are best seen at a distance of about one mile. The searchlight is of the converging type and is so arranged that the rays of light are focused to form letters. Mr. Gauthier states that neither the clouds in the sky are needed as reflectors, nor tall buildings as a screen.

We see him demonstrating the giant searchlight. Of course, the photograph is a specially posed one to show us just the type of sky lettering the equipment produces; when in use, the lettering would be miles from the operator.

Tuning In Radio Programs with New Dial System Having Number Combinations

A DIALING system, similar to that used with the new telephones, may come to occupy an important place in the home of the future if the system of remote control by means of which radio programs and recorded music may be brought into different rooms of a house by dialing simple number combinations comes into extensive use.

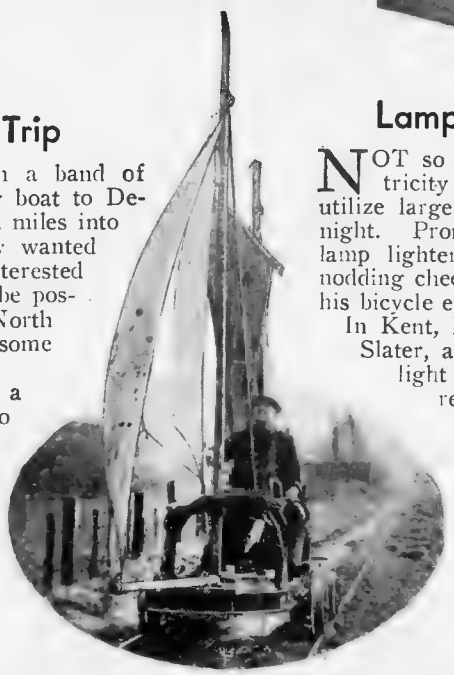
The new system, which was developed by the engineering products division of the RCA-Victor Company for special phonograph-radio installations, employs the same principles used in the dial telephones that have recently come into such wide use. Miss Dorothy Love is tuning in with one of the dials. A simple dial control, mounted on a small ornamental box with a pilot light, is installed at desirable locations throughout the house, and connected to a master phonograph-radio outfit located in the attic or basement. Complete operating control of both the radio and automatic phonograph is provided by each dial station. Up to 18 different stations are pre-tuned, and adjusted to the master dial unit to respond to easy code number combinations. The automatic phonograph is similarly adjusted for each of its functions.

Submarine Starts Polar Trip

LAST year Sir Hubert Wilkins, with a band of equally brave adventurers, went by boat to Deception Island, and then flew six hundred miles into the icy Antarctic regions. He not only wanted to visit and map this region but he was interested in determining whether or not it would be possible for an exploring party to reach the North Pole with a submarine traveling for some distance under the ice.

Having convinced himself that such a journey was feasible, upon his return to civilization he immediately organized an expedition and stated that he would set forth for the Antarctic some time this year, making the entire trip by submarine.

Now the *Nautilus* has started on the first leg of its 20,000 mile journey. Under the command of Lieut. Commander Sloan Danenhower it left Philadelphia for the Navy Yard at Brooklyn, where it was officially named the *Nautilus* on March 24th.



The home-made land-going yacht with its builder at the helm.

Lamp Lighter Uses Land Skiff

NOT so many years ago, before the use of electricity became common, it was the custom to utilize large gas lamps to keep the streets bright at night. Promptly at twilight the city's official gas lamp lighter would ride up and down the streets, nodding cheery "good evening" to folks as he stopped his bicycle every few seconds to light a lamp.

In Kent, England, the system employed by W. H. Slater, a retired naval officer, whose duty it is to light the riverside wharf lamps at Cliffe Kent, recalls this old custom. Instead of using a bicycle for his five mile trip, Slater has constructed a novel land yacht from an old truck chassis, and sails to his work over steel rails.

Iodine Well in Daghestan

DURING explorations in Daghestan, U. S. S. R., according to the *Economic Review of the Soviet Union*, a powerful water gusher was struck with a daily capacity of 50,000 cubic meters. The research laboratories of the Azneft Oil Institute have established the fact that the water contains iodine and radium; 13.6 milligrams of iodine to every liter of water (about ¼ grain to a quart). The annual output of iodine is estimated at 250 tons, more than sufficient to satisfy the needs of the entire country. It is estimated that a factory for the manufacture of iodine could be built in from four to five months at a cost of one million rubles.

The Soviet Union has shown a great deal of interest in iodine production. Several furnaces to burn seaweed to extract iodine from the ashes (known as kelp) are being built.

The "Nautilus" leaving Philadelphia under its own power for the Brooklyn Navy Yard, where it was rechristened.

As Harry W. Bull, the 21-year-old designer and builder of the B.R-I, threw the switch to explode the rockets which propelled his craft, the sled leaped ahead, trailing sheets of flame and clouds of smoke. The hundreds of spectators scattered instantly.

Rocket Sled Makes 85 Miles Per Hour

A SMALL silver plane-shaped craft, propelled by rockets, shot 50 feet over the ice in two-fifths of a second at Oneida Lake, New York, thus establishing the first rocket ice-boat record.

A crowd of 500 had collected to see the test flight. The inventor of the sled, Harry W. Bull, a 21-year old student at Syracuse University, piloted the boat. He sat calmly in the tiny cockpit, and, with a steady hand threw the switch that set off the battery of rockets placed on either side of the craft.

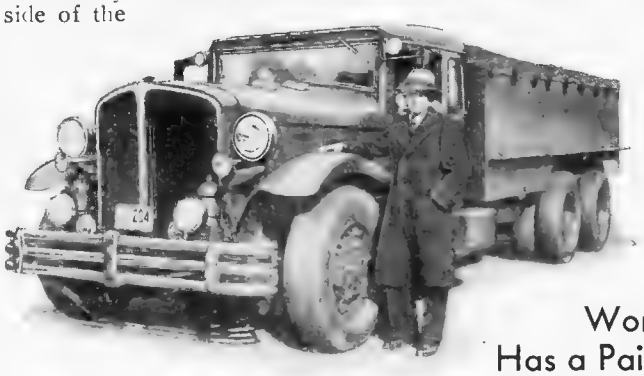
Blinding flashes of flame shot out from both sides of the sled and a crashing roar assailed the ears of the spectators, as it leaped ahead with bullet-like speed. Swerving from the narrow shoveled course that had been prepared, the sled plowed through the heaped snow which clogged its runners and pivoted it around like a pinwheel.

The awe-stricken spectators scattered quickly as the sled spouting flame and smoke, whirled dizzily about and pointed straight back toward them. In a few seconds the smoke had cleared, and calm was restored.

It had been the young inventor's intention to ignite the 32 remaining rockets and attain a distance of at least 1,500 feet. Because of the soggy ice, the short expanse of clear space available, and the two-inch fall of snow, he did not attempt this.

New Asteroid Is Discovered

ASTRONOMERS at the Harvard College Observatory have announced the discovery of a rapidly moving object in the heavens, "probably a peculiar asteroid, perhaps of the type of Eros." Because of its rapid motion they conclude it is comparatively close to the earth, and feel that it may resemble Eros, the little asteroid, which swung within 16,000,000 miles of the earth in January, nearer than any other planetary body has approached.



World's Largest Motor Truck Has a Pair of 275-Horse-power Engines

A GIGANTIC six-wheeled truck, powered by two engines, each of 275 H. P., is being exhibited at Washington, D. C. The motors are of the eight-cylinder type. As they are connected to separate rear axles, they may be operated individually or together by the driver. Air-brakes are fitted to act on all six wheels.

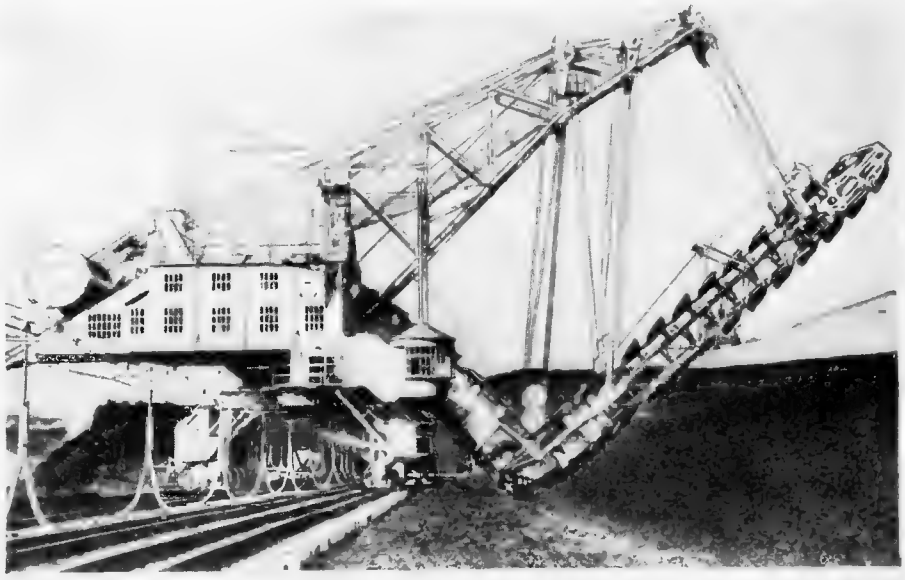
The truck weighs 20 tons, and equals the weight of 12 to 15 cubic yards of wet concrete, or 5,000 to 8,000 gallons of gasoline, oil, or milk. A. Madle, the designer, is standing alongside it.

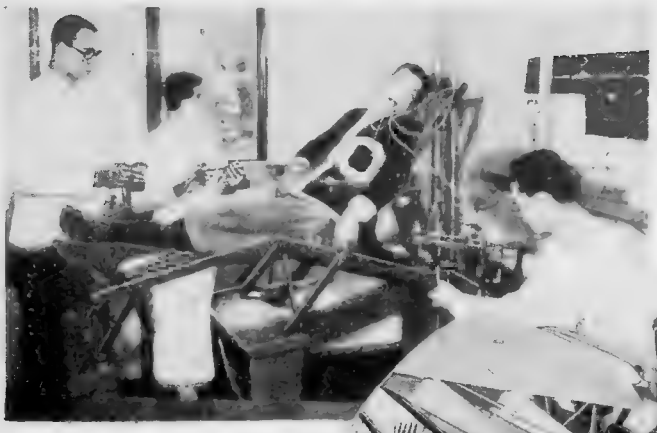
Mammoth Electric Shovels for Coal Mines

MAMMOTH shovels, for which the average railroad train makes just a comfortable load, are being manufactured for dumping coal. They are electrically driven.

The model illustrated is a shovel in use in Germany. It is of the endless chain bucket type, runs on rails, and is wide enough to straddle a pair of railroad tracks. The machine is over 80 feet high, and can scoop and load about 1100 cubic yards of coal per hour. The shovel can reach materials that are 48 feet distant from it in any direction.

The largest shovel in the world, however, is the combination digger and loader manufactured by the Marion Steam Shovel Company for use in the mines of Du Quoin, Illinois. This shovel weighs 1,600 tons—more than fifty times that of the average power shovel employed in excavation work. The bucket moves at the rate of 20 m.p.h.





Oreb Hobbell, a student at Colgate University, is working wholeheartedly for the cause of science. He's being experimented on by Dr. Donald A. Laird and his assistants to determine just what happens in his system when he eats sweets.

Checking Up on Sugar—and Sleep

WHAT happens to the muscles of your stomach when you eat sweet foods? To the flow of gastric juices? Of saliva? How are the organs of digestion affected when foods that vary in taste enter your mouth?

These are just a few of the questions which Dr. Donald A. Laird and his associates in the psychological laboratory of Colgate University are seeking to answer. Oreb Hubbell, a student at the college, is helping them. In the photograph we see him under observation.

Another subject which Dr. Laird is investigating is sleep. Physicians have been requested to send to his laboratory patients who find they sometimes sleep less soundly than they should. Only normally healthy individuals are wanted; records of how long it takes them to fall asleep when no attempt is made to induce sleep will be kept. These will be checked against another set showing how the taking of warm drinks, warm baths, or walks before bedtime affect their slumbers.

This Plane Won't Crash

IT seems G. W. Cornelius, the inventor of the craft pictured above, and Albert Adams Merrill, whose foolproof plane is described elsewhere in the *Spotlight of Science* had the same idea in mind in constructing a crash-proof plane.

Mr. Cornelius's model was recently accorded a tryout in Los Angeles; it did all he claimed for it.

Regardless of how poor a judge of distance a pilot of either plane may be, once the engine is turned off, the proper landing position will be maintained until the craft reaches the earth. In other words, no guidance from the pilot is necessary to effect a landing. When power is put on again the plane assumes a natural flying position.

For Globe-Trotters

ONE of the main obstacles that confront the eager-to-view strange lands or seafaring traveler is his inability to shift from land to sea and back again with one machine. This globe-trotter, whose photograph was snapped as he cycled through the streets of Rotterdam, has solved the problem to his own satisfaction.

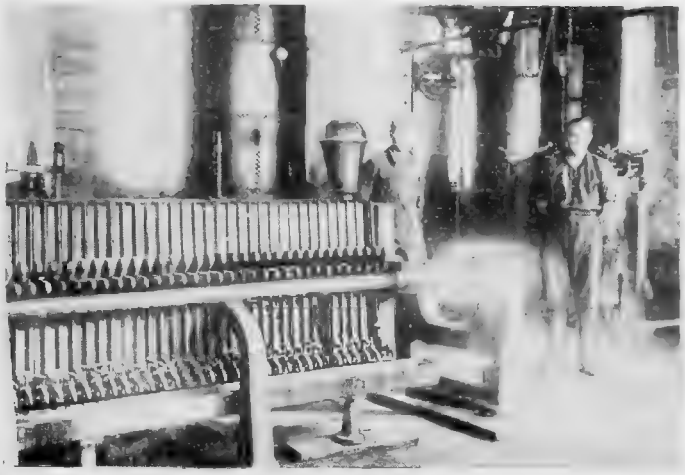
His motorboat is mounted in a trailer, attached to his motorcycle which pulls it along while he is indulging in land sight-seeing. When he reaches a river or canal, the uses of his equipment will be reversed; he'll sail on in the motorboat, while the motorcycle will be carried.

Had the young rider decided to go through the United States with this equipment, we're afraid that his sight-seeing would have been restricted to evenings because of traffic congestion.

Putting the Dolphin to Good Use

ONCE upon a time the dolphin, or porpoise, was a common article of food. Now that porpoise meat has gone out of fashion, our Soviet friends are doing their best to utilize both his skin and fat. They have built a new dolphin mill near N. Afon, U. S. S. R., to receive the catch of the Black Sea.

Directly below, we can see melted dolphin fat being filtered through a filter press; the oil thus obtained is an excellent lubricant for watches, clocks and other delicate mechanisms. It neither gums or thickens through oxidation, it will not corrode metal, and has the rare ability to withstand exposure to the very low temperatures without freezing or thickening to any great extent. The hides will be stripped from the dolphins after which the skins will be converted into a leather resembling chamois.



Will This Robot Read Your Character?

AT the beginning of the nineteenth century, F. J. Gall founded a new school of psychology—using a system he called phrenology. The followers of this pseudo-science, which to our mind, ranks slightly lower than numerology and graphology, believed that the moral, intellectual and sensual dispositions of an individual could be ascertained by examining the outside of his skull. The bumps were supposed to indicate the contour of the brain surface within.

For a while, phrenology flourished as a method of character reading. Then its popularity waned. Perhaps the commercial production of the *Psychograph*, a robot phrenologist, invented by Henry C. Davery, of Superior, Wis., will help to restore it to favor.

The cap of the instrument is adjusted on the head; current is switched on. The properly graded electric impulse is transmitted to the recording device. A typed reading is automatically delivered.

Tuning in on the ether waves, the members of the first ether orchestra extant produced the tones of any musical instrument. A piano string drawn over a steel bar furnished the necessary apparatus.

Introducing the Ether Orchestra

A FEW weeks ago the population of Copenhagen, Denmark, had the opportunity of *hearing* history in the making. For the first "ether orchestra" to be organized gave a concert there. Each musician played a very simple instrument—a piano string spanned over a steel bar. The four members of the orchestra claim that they can imitate tones of the violin, piano, cello, clarinet, in fact they believe that those of every known musical instrument can be reproduced with proper fingering.

Pontoon Bridge of Barrels

FROM time immemorial, floating bridges of vessels bearing a roadway of beams and planks have been employed for the transportation of men and supplies across bodies of water. During the World War, our soldiers strung several flat-bottomed wooden boats together and anchored them with steel or wooden supports to make a temporary pontoon bridge.

Today a pontoon bridge, although no novelty, is not found on many rivers. One made of ordinary wooden barrels, anchored permanently across a stream, is quite unusual. The residents of Hackensack, New Jersey, use this little foot-bridge every day without giving it a thought. It is made of fifteen barrels strung across the current; cross pieces of wood are fastened between the barrels; long planks of wood serve as a footpath. It is securely moored at both ends.—*H. E. Zimmerman.*

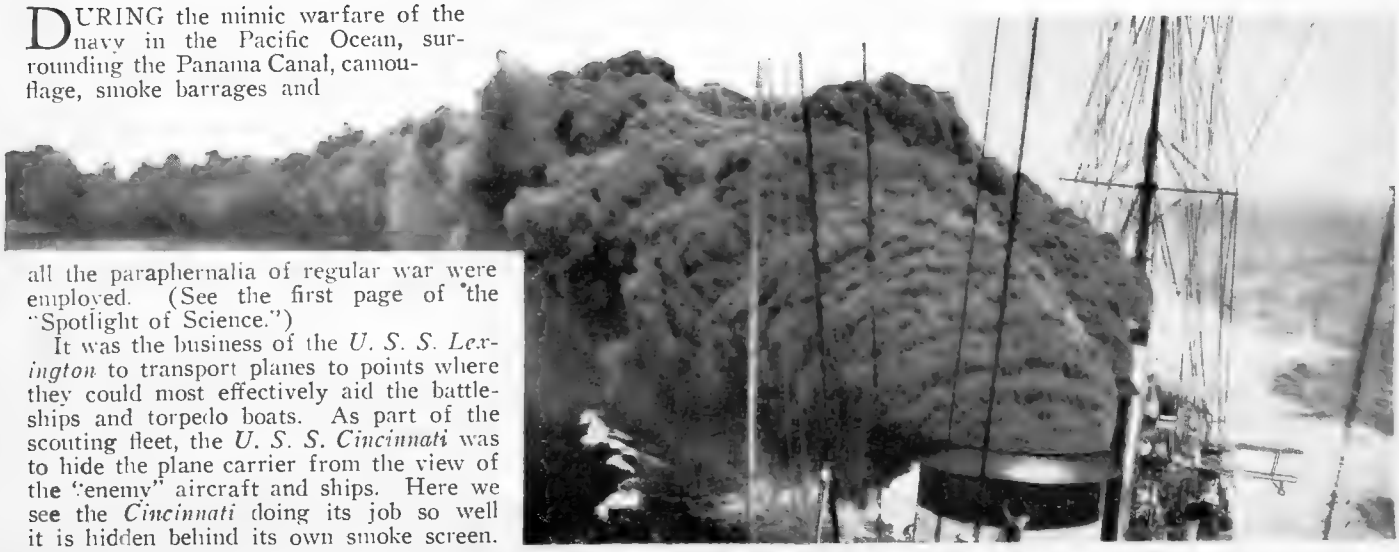
The Birth of Safety Glass

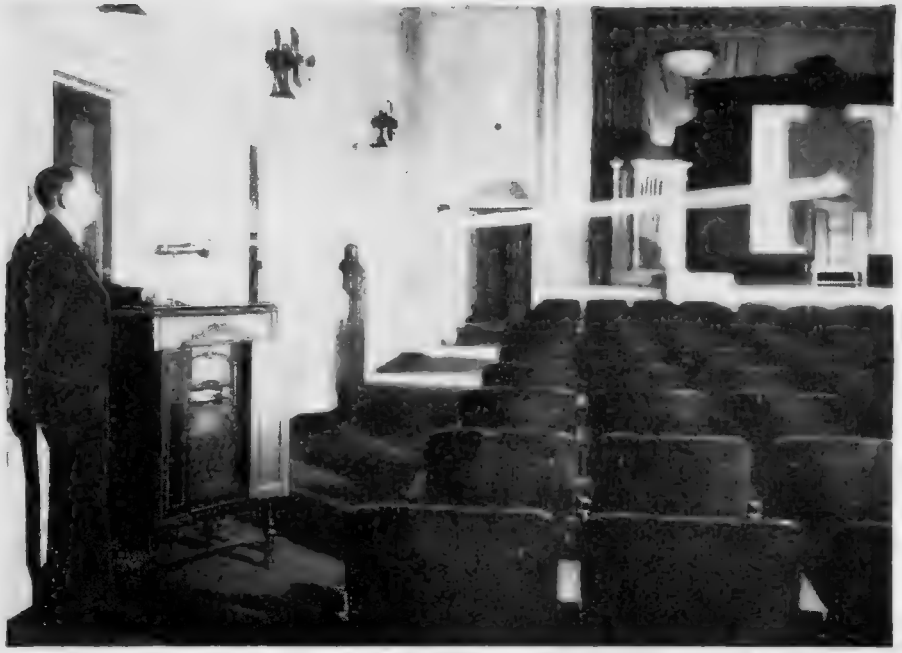
THE safety glass, now used extensively for automobile windshields and armored car windows, came into being through accident. Eduoard Benedictus, the French poet-chemist who died last year, accidentally knocked down a test tube while rummaging around in his laboratory. It fell to the floor with a crash. When he picked it up, he found that though the glass had cracked into many pieces, the tube still retained its form. Investigation revealed that each separate splinter of glass was held in place by the dried up mixture which had been in the tube for years. It had contained a solution of trinitro-cellulose, ether, acetone, and amyl acetate. Experimenting with combinations of these chemicals, he made safety glass.

The U. S. S. Cincinnati Does Its Job Well

DURING the mimic warfare of the navy in the Pacific Ocean, surrounding the Panama Canal, camouflage, smoke barrages and all the paraphernalia of regular war were employed. (See the first page of the "Spotlight of Science.")

It was the business of the *U. S. S. Lexington* to transport planes to points where they could most effectively aid the battleships and torpedo boats. As part of the scouting fleet, the *U. S. S. Cincinnati* was to hide the plane carrier from the view of the "enemy" aircraft and ships. Here we see the *Cincinnati* doing its job so well it is hidden behind its own smoke screen.





Light Beam Transmits Speech and Music

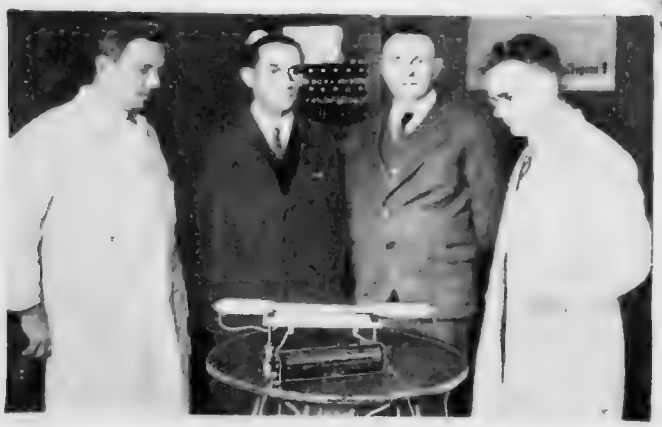
RADIO and recorded music from a standard radio-phonograph were transformed into beams of light, transmitted to another radio receiver, and converted back into their original sound by Dr. V. K. Zworykin, research engineer of the R. C. A. Victor Company and his assistants, at a demonstration in Philadelphia.

At the transmitting end, a radio was tuned in on a local station; instead of allowing the program to be reproduced directly through a loud speaker, the electrical impulses were passed through a transformer and converted into light by a neon lamp. This light was focused by a lens and projected across the auditorium to a mirror, which, in turn, reflected it back across the room to the receiving apparatus.

There it was concentrated on a photo-electric cell by means of a parabolic reflector, converted into electrical impulses again, amplified, and reproduced by the loud speaker. The reflecting mirror merely increased the distance which the beam of light traveled.

To vary the program, speech was next sent through a microphone, converted into light and reproduced in the same way. Finally, a recorded musical selection was played; it went out on a beam of light, was re-recorded with the standard home recording apparatus in the receiver, and then played back to the audience on the newly made record.

Dr. V. K. Zworykin demonstrating how speech and music may be transformed into light, transmitted to a photo-electric cell, and converted back to their original sound.



From left to right—George Gaides, engineer; Professor Marcelle Pirani, Dr. Hans Ewest; and Dr. Martin Reger, with their invention, which consists of a light tube and a heating device for producing sodium vapor.

Long-Distance Weather Forecasting

WHEN the weather man prophesies that we'll have rain the next day, and the sun shines gloriously, we forgive his inaccuracy, because we know it's not his fault. A good deal must be discovered before predicting the weather for a day, a week, or a month in advance becomes an exact science.

Dr. Charles G. Abbot, secretary of the Smithsonian Institution is quite sure that the sun's radiations contain the key to the weather. For thirty years he has been checking the variations of the sun's heat against heat, moisture and other climatic factors with the instruments he is shown using in the photograph.

His theory recalls that of the famous "Padre of the Rains," Father Jerome Ricard of the Santa Clara Observatory in California. The "Padre" believed that shifting spots on the sun's surface

indicated weather changes; and that the output of solar heat (upon which Abbot bases his calculations) varied through the influence of these sunspots.

For Everything Under 10,000 Pounds

THIS scale is usually used for weighing ingots of gold and other metals, from one pound to 10,000: yet it is constructed so delicately that the average person can ascertain his weight with absolute accuracy when care is taken to read the index hand. This scale was placed on demonstration at the Western Metal Congress held recently in San Francisco, California. Here we see Miss Marian Schrieber perched on a platform supported from the balance, enjoying her swing.

More Light with Sodium Vapor

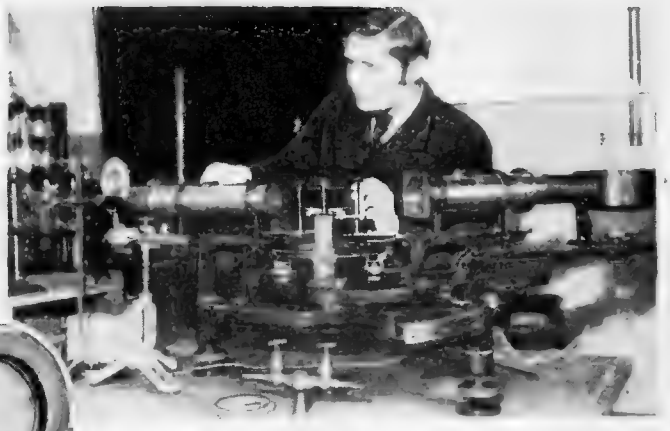
UNDER the proper physical conditions, you can heat sodium in a glass tube and generate light. So says Dr. Marcello Pirani, of the Osram Electrical Bulb Factories of Berlin, Germany.

At a meeting of the members of the German Association for Technical Physics there he demonstrated the production of light with a filament-less sodium-steam tube, heated by a device he and his associates perfected. So far, the conditions necessary for effecting the transformation have been produced only in his laboratory. About 80% of the electrical energy fed into the tube turns into light, as against 4% usually obtained, it is claimed.

Sun's Rays for Electrical Power

FOR ages, man has been trying to utilize the sun's rays for the production of electricity and electric power to operate motors and power plants. Imagine what an epochal event the commercial application of such energy would prove!

Dr. Bruno Lange, a 29-year-old German scientist of the Kaiser-Wilhelm Institute, in Berlin, claims that he has succeeded in transforming sun-rays into such power, which can be readily adapted for industrial purposes. His process was effected through individual research. When announced it created a sensation throughout Europe, particularly among the power interests, whose holdings will undoubtedly depreciate in value, should the young scientist's method prove practical. The simplicity of his sunlight-electricity producing machine is surprising. A layer of cuprous oxide is spread over a thin copper plate, to which two wires are attached. When a ray of sunlight strikes the plate, the wires instantly pass sufficient electricity to light a bulb, or drive a motor. The current is obtained at a potential of half a volt. The cuprous oxide photo-electric cell has been experimentally used in America.



Dr. Bruno Longe at his desk in the Kaiser-Wilhelm Institute, determining effects of different colors of light on his photo-cell. Below—Photo-cell for transforming sunlight to electricity.

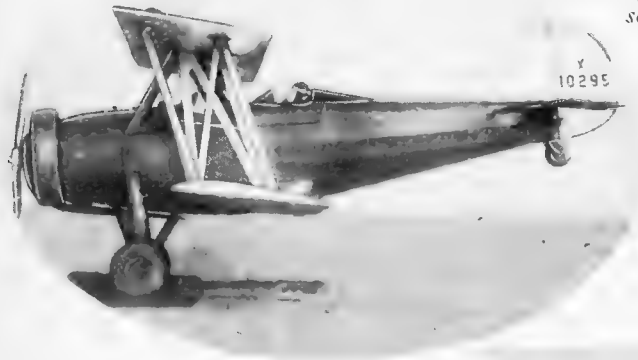
Whistling Pots and Self-Opening Windows

THE home of the future will be equipped with numerous automatic conveniences undreamt of today except by farsighted inventors, believes the well-known English physicist, Professor A. M. Low. Meals will be cooked in automatic pans that whistle or otherwise signal when the food is done. An infallible electric probe dipped into a dish will determine the exact amount of salt or pepper one likes; you will not depend upon the cook's varying taste. Different rooms in your house will be heated automatically to different temperatures (prescribed by the family physician) for activities such as work or play or sleep, that should be performed in atmosphere heated to various degrees. Windows will open or close at one's desire; no servants will touch them; a mere whistle will do the trick.

Professor Low feels that inventing automatic devices for saving time and labor provides the most lucrative field for inventors. He himself has built a machine which makes a cup of fresh, hot tea for him in the morning, wakes him with an electric chime when the tea is ready, and pulls the covers off the bed five minutes later. He admits that the device is too expensive for general use at the present time.

Landing Safely With Your Hands Off the Controls!

HERE'S a stunt and foolproof plane that any novice can fly safely, and land without a mishap, even though his hands do not touch the control sticks.



Pilot Henry White demonstrated this half a dozen times at the Curtiss Airport in North Beach, Long Island. As he waved his hands in the air, the plane made a beautiful two-point landing, as you can see. Says its inventor, Albert Adams Merrill:

"The plane will never nose over because of improper stabilizer adjustment or overcontrol in the hands of an ignorant or careless pilot. The machine can neither stall nor dive. It will not spin and no one has yet been able to loop it. . . . With the wings set at maximum angle and the engine cut, our ship will at once assume the proper gliding angle and will land if the pilot does not interfere with it."

All this is achieved through the automatically controlled, movable wings. The plane has no stabilizer in the ordinary sense—the stabilizer's task has been transferred to the lower wing, which is rigidly connected to the upper one. Both move mechanically.

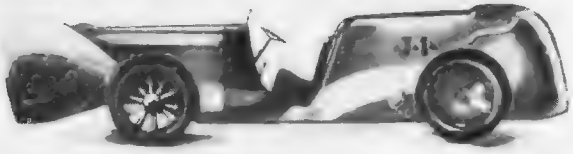
Shooting the Mail

WE'VE never shot a line through the air and conveyed mail bags along it. That's what our English neighbors are doing. As the destroyer H. M. S. *Windsor* drew alongside the H. M. S. *Nelson*, a Schermuly gun was fired from the *Nelson;* the line it projected was shot across to the deck of the destroyer. A bag of mail was then transported along the line and members of the crew of the *Windsor* hauled up the load of mail.

Automobile Driven by Compressed Air

We have had rocket cars and Diesel-engined cars — finally a compressed air auto has appeared.

ONE of the cars to be tried out on the "Avus," Berlin's famous automobile racing course, is an automobile driven by compressed air instead of gasoline. It is the invention of Herr Erwin Jungfer of Silesia. It is stated that an electric motor provides power for operating the compressor. As yet no information has been given as to the source of the electric supply.



Steel Bow and Bowstring

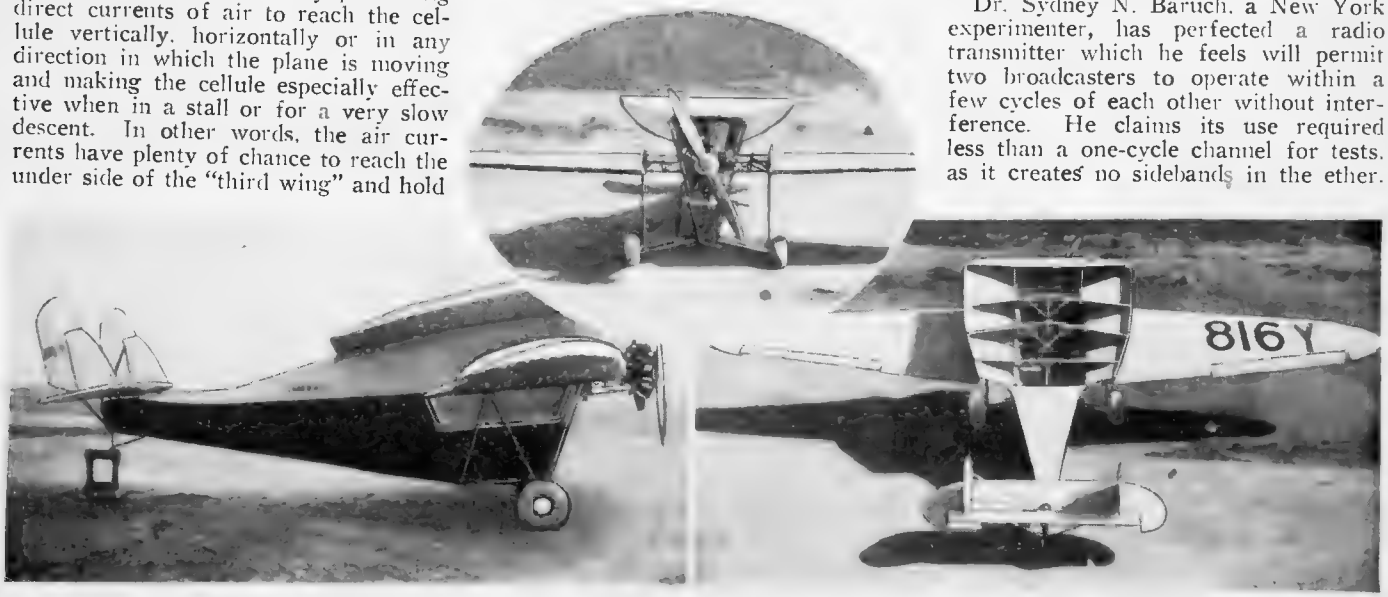
IN archery practice, did you ever shoot at a target using a bow made of steel? No? Well, the American Fork and Hoe Company has just put one on the market. Instead of having a bow of wood, and a bow string of cord or gut, the bow proper is made of V section chromium steel; the string of twisted steel wires. The bow can be taken apart; it is rustproof, almost unaffected by wear, and, unlike wood, will retain its elasticity and shape despite constant use. Considering the power developed, its weight is extremely light. Marian Hartley of Chicago is seen inspecting one of the first models.

This Airplane Has Three Wings

DESIGNING it especially to secure slowness in descent and slow landing speeds under any conditions without injury to occupants or machine, Edward H. Lanier of Covington, Kentucky, has developed an airplane with three wings which already has undergone nearly fifty successful flights, at altitudes as high as 3,000 feet, and under the guidance of four different pilots.

The "third wing," or more technically the high lift cell or cellule, flares out over the top of the fuselage and, according to the inventor, acts much like a parachute, making it unnecessary to land the plane in a fast glide at any time. The main wings are separated from the fuselage by a gap of twenty inches on each side, thereby permitting direct currents of air to reach the cellule vertically, horizontally or in any direction in which the plane is moving and making the cellule especially effective when in a stall or for a very slow descent. In other words, the air currents have plenty of chance to reach the under side of the "third wing" and hold the plane in a rigid position for landing slowly.

"The third wing or cellule," said Mr. Lanier, "lifts more than one-half the entire weight of the machine from over the center of gravity and automatically allows a reduction in the wing surface, that is, reduces wing lift not over the center of gravity. The dihedral form of the under sides of the third wing, aided by suction lift and a low center of gravity, produces a rigid vertical stability in the fuselage sufficient to prevent side slipping into a spin."



Keep Eggs Fresh for Over A Year

A UNIQUE machine which preserves eggs for more than a year has been developed by the Murray Brothers Machine Works of San Francisco. They utilized Westinghouse electrical equipment in constructing it. The new equipment, which is capable of handling 34,560 eggs per hour, operates faster than any others extant, has automatic heat control, is easy to operate, and eliminates breakage of the eggs.

The machine consists of trays arranged to move at a set speed in one direction on two endless chains, one attached to each side of the tray. The tray is covered with micarta to prevent checking or marking of eggs. The eggs are inserted into holes in the tray, conveyed to a heating tank, where they are immersed in a thermostatically controlled bath of hot mineral oil for a specified time. Then the eggs are removed with a huge fork and packed.

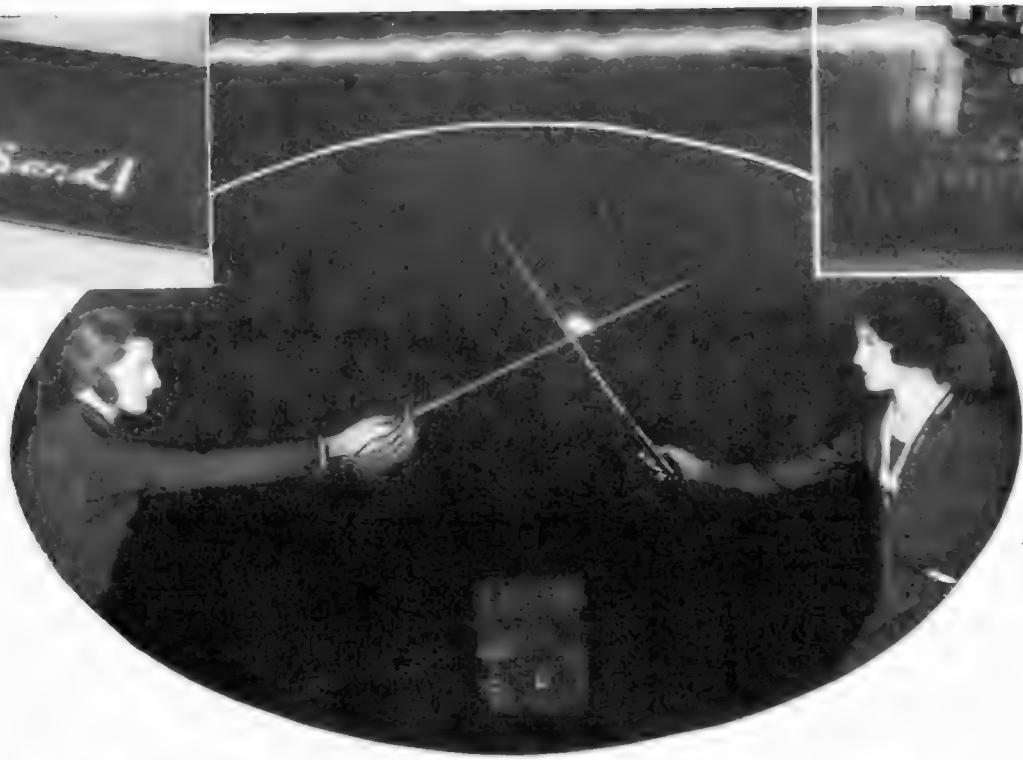
As eggs are seasonal products, their processing plays an important part in modern food conservation.

Doing Away With Interference

QUITE often when the listener has settled down in a comfortable arm chair prepared to enjoy his favorite station, two radio programs will come in at the same time. To reduce this annoyance as much as possible a ten kilocycle separation channel is now maintained between the operating wavelengths of broadcast stations.

Dr. Sydney N. Baruch, a New York experimenter, has perfected a radio transmitter which he feels will permit two broadcasters to operate within a few cycles of each other without interference. He claims its use required less than a one-cycle channel for tests, as it creates no sidebands in the ether.

Fig. 1—Letters of metal paint applied to a bakelite or hard rubber panel, in back of which is placed a grounded metal plate, will glow when touched by the electrode.



Above the oval. Fig. 2—A hair-thin wire, when connected to the machine will exhibit this remarkable halo. Left. Fig. 3—An electric duel may prove more exciting than the real thing.

Fun With a Violet Ray Machine

The Old Fashioned High Frequency Machine Stored Away in Your Attic Will Provide an Endless Source of Merriment Through These Spectacular Demonstrations

By Thomas Malloy

MANY people have a violet ray machine lying around. They do not realize that they can perform a number of striking and very interesting experiments with it. Several attractive demonstrations which can very well be used for impromptu parlor and lodge entertainments are here described.

The average violet ray machine operates on what is known as the Oudin high frequency arrangement. The hook-up includes an interrupter comprising a magnet coil surrounding an iron wire core which periodically attracts a vibrator spring. The 110-volt alternating or direct current thus interrupted through a pair of silver or tungsten contacts on the interrupter spring and screw respectively also passes through the primary coil of the Oudin high frequency transformer. A high frequency current is set up in the Oudin primary, due to the action of the high voltage condenser. This high frequency current in the Oudin primary induces a current of much higher voltage and similar frequency in the secondary coil of the Oudin transformer.

The high voltage, high frequency current in the secondary winding manifests itself in a spark discharge.

The average small size violet ray machine yields a spark about one inch long when a piece of wire is inserted in the socket in which the glass vacuum electrode is ordinarily placed.

The production of letters of fire as illustrated in Fig. 1 is a very beautiful demonstration. This display is of unusual interest as it was one of the early experiments conducted by Nikola Tesla nearly 40 years ago. The characters and even complete sentences may be formed of wire, metal foil or gold or aluminum paint on the surface of a piece of bakelite or hard rubber about 3/16 of an inch thick. A metal plate somewhat smaller than the panel is placed behind it and connected to a ground such as a water or steam pipe. A ground connection should be used because a more powerful spark discharge is obtained.

Hair-thin insulated wires when connected directly to the high voltage terminal will exhibit a most colorful glow. If you wish, you can shape the wire to interesting forms. Fig. 2 will give you an idea of the effects which can be achieved.

If you are a fairly good showman, a great deal of fun can be evolved before an (*Continued on page* 164)

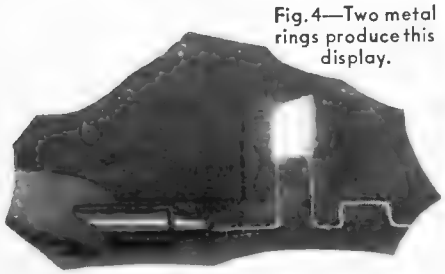


Fig. 4—Two metal rings produce this display.

Fig. 5—The circuit is from the high voltage terminal to a nail in the subject's mouth. The high frequency current travels through his body and jumps to the lamp filament. Thence to the filament of the second lamp, to the hand of the individual holding it and to the ground through the wire.

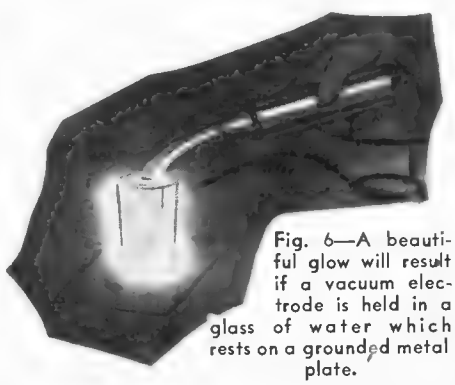


Fig. 6—A beautiful glow will result if a vacuum electrode is held in a glass of water which rests on a grounded metal plate.

A Million Edged Tool

How Metals Are Cut by Modern Multiple Edged Tools Which Travel at a Rotary Speed of a Mile a Minute

By Alfred S. Kinsey

Professor of Shop Practice, Stevens Institute of Technology; Member American Society of Mechanical Engineers

IF one were to place the cutting edge of a steel cold chisel against a piece of steel and strike the head of the chisel with a hammer, a chip of metal, more or less curled, would rise ahead of the chisel edge. That would be very slow one-edge cutting. Then, were it possible to reduce the size of the chisel till it could hardly be seen by the naked eye and change its composition from that of a mass of grains dominated by iron carbide, called *steel*, to a similar mass of grains influenced by, say, aluminum oxide, called *manufactured abrasive*, and have not just one, but a million or more of these powerful little tools (Fig. 1) held together at uniform spacing to allow each edge freedom to cut, the single-edged cold chisel would become a million-edged grinding wheel, with its myriads of sharp surface grains

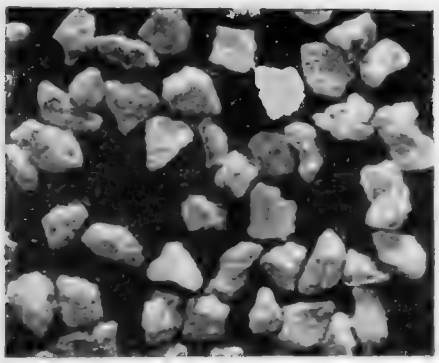


Fig. 1—Grains of manufactured aluminum oxide abrasive for grinding. Their sharp, tough edges will cut the hardest metals as they are, in wheel form, made to travel at a speed of a mile a minute.

striking against the metal being ground at an impact force equal to a speed of a mile a minute. That would be the fastest multiple-edged cutting tool.

If these minute tools were sharp and struck true, the four or six or eight-sided grains of the metal of the job would be split apart, *cleaved*, along their boundaries, and the resulting curled chips (Fig. 2) should leave a smooth surface on the work. But if the wheel grains were dull, and the spaces between them, *interstices*, filled with foreign matter, the removal of the particles of metal, *grinding*, might be accomplished by fracturing the grains through their fern-like crystals, and the surface of the job would then have a roughened appearance.

This million-edged tool is a wonderful example of man's handiwork. There is no metal its flying grain-edges cannot cut, no material too hard or too rough to resist its penetrating power. And they can be made to stay so true to form that the precision of their work is almost unbelievable. A change of position equal to .000005 inch of the supporting parts of a grinding machine will instantly be indicated by a change in the fiery sparks from the edges of the wheel grains. The best automobile practice calls for the grinding of engine parts, like wrist-pins, to be exact within .0002 inch.

The little grain-tools are of peculiar origin. Once they were taken from the mountainside, where they had been pressed tightly together by nature, and the rough-shaped mass, *sandstone*, had but to be put in circular form for service as the old familiar grindstone. There were other natural abrasives, like *emery* and *corundum*, which being uncombined and in the form of chunks of grit, required an artificial bond of clay. The cutting edges of these grains dulled quickly. Metal working plants were making things of tougher, harder metals and materials which required stronger, sharper grinding wheels.

Then came the romance of the manufactured abrasive. An experimenter in Pittsburgh melted some coke and sand and produced crystals of silicon carbide, glass from the sand, carbon from the coke. A few years later some men experimenting in a shed at Ampere, New Jersey, discovered that they could produce an artificial abrasive similar to emery by using the electric arc furnace to melt bauxite clay, which consisted chiefly of aluminum oxide. This fused mass clinker was crushed, bonded and moulded to grinding wheel form.

Next, the power of Niagara's waters was transformed, by electric generators, to electric energy to supply the melting heat for the huge furnaces for fusing the elements of the bauxite clay, for alundum abrasive wheels, and for electric resistance furnaces, Fig. 4, to fuse the sand and coke to produce silicon carbide for crystolon abrasive wheels. These silicon carbide and aluminum oxide abrasives still remain the two principal bases of artificial grinding wheels, known by several trade names like Carbolite, Carbolon, Carborundum, Carbosolite, Carbowalt, Corex, Crystolon, etc., for the silicon abrasive, and Adamite, Alowalt, Aloxite, Alundum, Borolon, Calcinite, Carbo-alumina, Combin, Corem, Corolox, Corowalt, Dessus, Diamantite, Jeddite, Lyonite, Oxaluma, Rebite, Rex, Rexite, Sterlith, etc., for the aluminum abrasive.

Photos Courtesy Norton Company

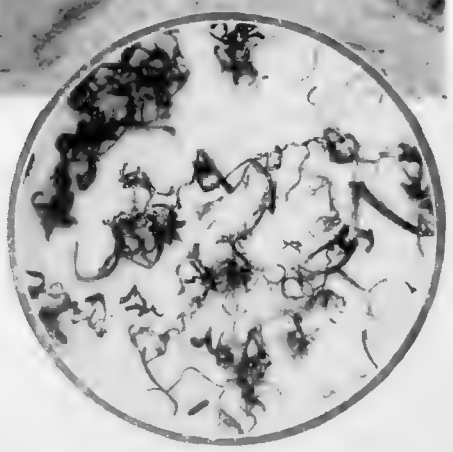
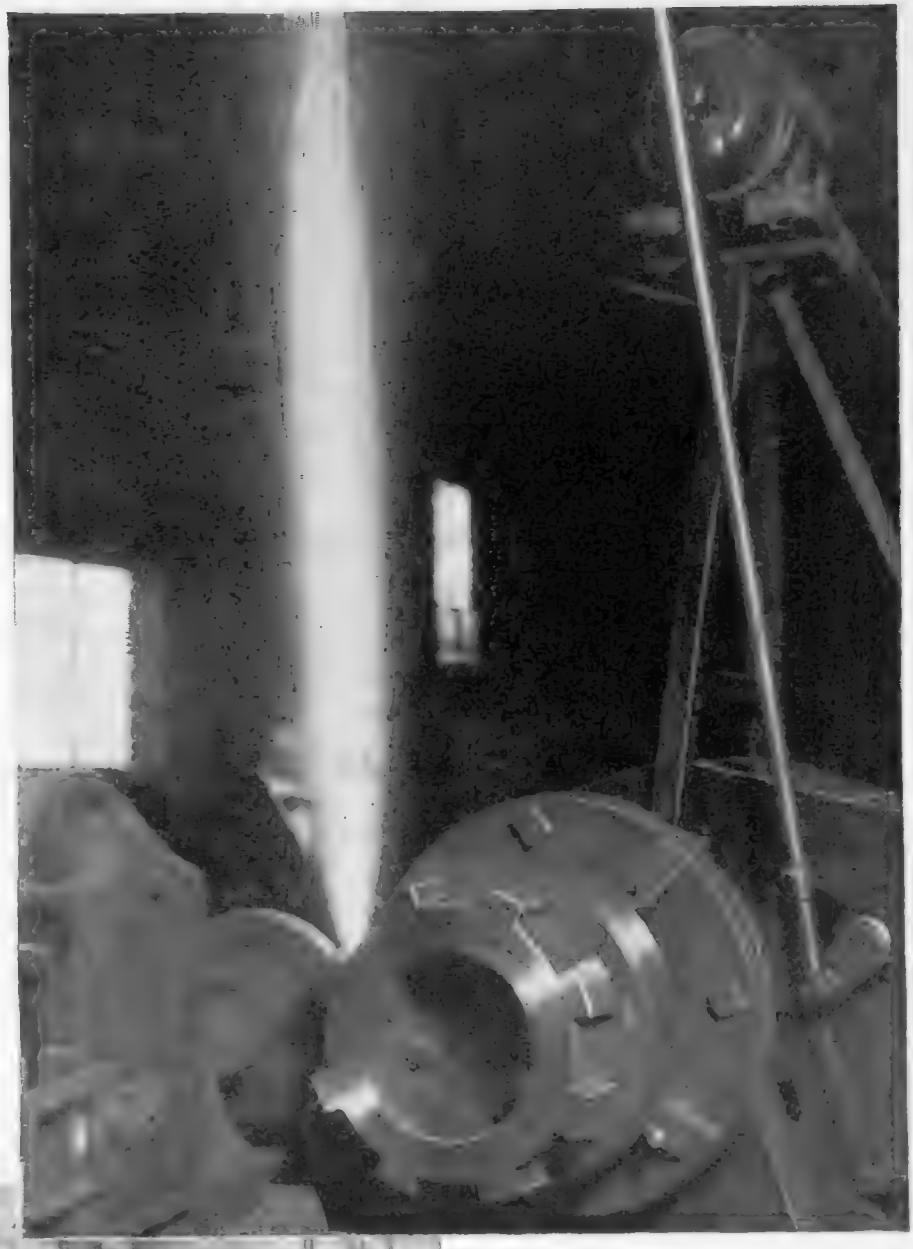


Fig. 3—Electric arc furnaces for making crystalline aluminum oxide abrasive, heated by current generated by water power at Niagara Falls, Canada. Fig. 2 (right)—Shavings from the grinding of steel, showing that the grains of manufactured abrasive were cutting properly.

The first manufactured abrasive, silicon carbide, is of special service because of its extreme hardness, although comparatively, it possesses but little toughness. On the other hand the aluminum oxide, while not quite so hard as the silicon carbide is much tougher. These characteristics definitely place each of the two abrasives in its own field of application, *i. e.,* silicon carbide wheels for metals of low tensile strength like many machine parts, and the aluminum oxide wheels for metals of high tensile strength, such as gears, alloyed steels and tools which have been hardened and tempered. These same abrasives apply to the grinding of forgings, castings, and machine parts of other metals besides steel.

The grains vary from a coarse size which will pass through a screen having eight openings to each linear inch, No. 8, to No. 240, the finest, which have been screened through meshes so small that there are 240 of them to each linear inch, or 240 × 240 equals 57,600 meshes per square inch. Sizes of grain finer than 240 up to 600 are prepared by special methods other than screening. The abrasive grains are held together, or bonded, by the use of feldspar, fusible clay, or silicate of soda, water glass, shellac, rubber, or bakelite. Grits and bonds are run into metal molds, the forms dried, shaved to size, burnt, trued, brushed, and graded as very soft, medium, hard, very hard. Balance and speed tests complete the preparation of the wheel for its mission.

Nothing could be of greater importance to this remarkable structure than the *bond* which holds the grains accurately spaced, sometimes called control structure, and produces the required clearance between their cutting edges so that they can deliver the effect of the



Photos Courtesy Norton Company

Fig. 6—Grinding the toughest steel safe door mechanism with manufactured abrasive wheel. Fig. 4 (left)—Electric resistance furnace for making silicon carbonide abrasive, heated by current generated at Niagara.

blow due to centrifugal force from the revolving wheel, well under the surface of the metal job. Nature supplied this bond in the old grindstone by using the pressure due to the weight of a one-mile thickness of ice back in the glacial period. Man makes a much stronger and more durable bond by the use of the high-temperature furnace, which enables the unseen natural law of cohesion to exert an unimpeded combining effect on the particles of grain and bond.

It is intended, of course, that a grinding wheel should be used for the specific work for which it was designed. The cutting action of the millions of grain-tool edges determines the practical value of the wheel. The silicon carbide abrasive may have its grain broken and the wheel will become glazed if it is used on too *tough* a metal, whereas the aluminum abrasive is peculiarly adapted to tough materials, and when used there the grains remain sharp. Some typical illustrations may be of value:

(a) The less refined the work, the coarser the wheel may be. The rough grinding of castings, *snagging* (Fig. 7) is done with coarse grained wheels.

(b) For smooth grinding the grain must be fine. Drills, taps, reamers, other small tools and precision work require comparatively fine grained wheels.

(c) Flat surface work is best accomplished with rather coarse soft wheels.

One of the common mistakes is that of running a grinding wheel too slowly. Just as it required a hammer blow to drive the cutting edge of the cold chisel into the metal to remove a chip, so the grain edges of a grinding wheel must penertate the metal surface of a job by the force of impact of grains and metal due to the speed of the wheel, and as this (*Continued on page* 181)

Below—The water-jump on No. 7 consists of a wood incline and a small mirror with putty around the edges. The putty is painted forest green to simulate a moss-grown bank.

Left—A view of the complete course. Compare this with the diagram at the bottom of the page. Below—This picture shows the method of holding the club, and also an interesting hazard.

A Nine Hole Golf Course on a Card Table

By Hi Sibley

BAD weather need not deprive the midget-golf enthusiast of his sport, for with this card-table course he can enjoy a foursome at his own fireside.

Nine holes, with all sorts of hazards, including a water-jump, are built on a wood base thirty inches square, and the complete set weighs only twelve and one half pounds. As all of the equipment, even the miniature settees and beach parasols, are securely fastened to the base, it can be leaned against the wall behind a door or stored in a closet when not in use.

After various experiments the writer found that a three-eighths-inch steel ball-bearing made a very satisfactory ball, and for a club we used a moulded lead head on a dowel stick.

The nine holes are laid out to give as great a variety of plays as possible in this limited space, making a par-26 course.

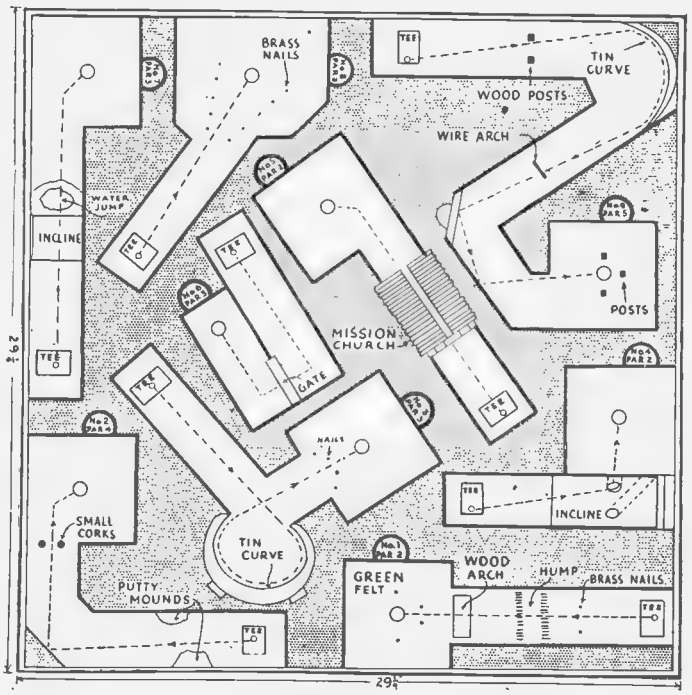
For the base select a light, soft wood, such as white pine, redwood or cedar. The timber should be ¾ in. thick and 9½ in. wide, net sizes. Three of these boards, 28½ in. long, are placed together and secured with the side pieces of ⅜ in. by 1¼ in. pine doorstop, mitred at the corners (Fig. 1). Flat-head brass wood-screws are used, well countersunk. Clips or jew nails, are driven into the underside to hold the edges of the boards flush, and the top surface is well sandpapered.

Next lay out the hole locations as shown in Fig. 2, directly below. Bore the holes about ½ in. deep with a sharp, ⅝ in. bit. If you are confident you can get the holes in their proper locations, it is well to bore all nine before going ahead with any of the other work. This permits turning the board upside down and getting all the chips and sawdust out. The edge of each hole should be beveled with penknife and sandpaper, Fig. 3.

Now start with No. 1 hole (Fig. 4). Note that all greens, except Nos. 6 and 8, are 5 in. square, outside measurements. Each green and fairway is carpeted with green felt, similar to the material used on billiard tables. This material generally is sold by the inch, at about 5 cents per inch in 36 in. widths. Eighteen inches will be sufficient, taken from a yard-wide piece. It will be necessary in this case, however, to piece the material here and there by bringing edges together, flush, and glueing to the base board. Such seams are practically invisible if neatly laid.

Apply glue around the hole in the base and lay the green felt over it—the hole having first been cut in the cloth, however. Be careful not to cut the holes too large in the felt. That is an easy blunder to make with this kind of material.

A wood "hump" is glued down under the fairway of No. 1, as shown, and the felt laid over it. The 3/16 in. wood strips around edges of green and fairway are nailed down over the felt with small brads. The wood arch on this hole is a simple job of whittling.



On No. 2 is a right angle turn, with a carom-block (Fig. 5) set at 45 degrees in the corner. Two putty mounds are located a few inches from the tee, and a pair of small bottle corks at the entrance to the green. These obstacles can be placed at your own discretion, depending on how easy or how difficult you wish to make your course.

An inside loop makes an interesting play on No. 3. This is constructed of a tin crescent, supported by wood blocks (Fig. 6). Bent to the proper curve, it will be a physical possibility to make No. 3 in one, although par is two. (*Cont'd on p.* 166)

An Electric Floor Waxer You Can Make

Luxurious, High Polished, Floors Can Be Yours. All That Is Necessary Is An Old Fan Motor, a Few Pieces of Scrap Iron, Odd Lengths of Wood, a Little Work on a Lathe and the Device Is Practically Completed

By Gale Vance

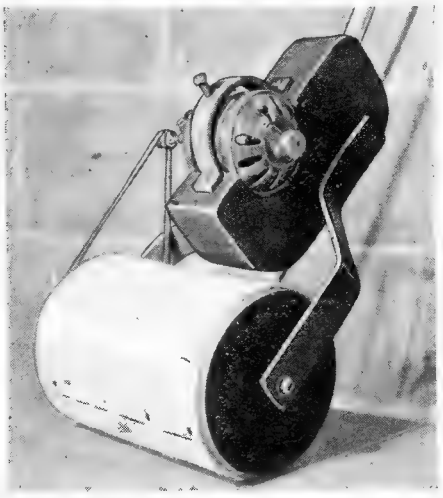
A POWERED floor waxer is a vexing thing. It's too costly for the average home because only seldom needed, and it's well nigh indispensable when the need arises. That's why renting them is the popular thing to do. Unless, of course, you have a flair for making things from odds and ends, in which case you can make one in, we'll say, a short afternoon.

Of prime importance is the motor—of good starting torque, high speed and ability to run under a load without overheating. I used a heavy duty sewing machine motor; believing this to have ample power—but it was slightly overtaxed and right here let it be said that an ordinary 14-inch fan motor, developing about 1/12 H. P. will be about right. You may even have a 1/6 H. P. motor and while this is large and will add quite a little to the polisher weight, it will have plenty of pull. In other words a range from 1/6 to 1/12 should be all right. And if the motor has a round housing so much the better.

This motor is first fitted into a suitable supporting block, being 8 inches long, 4 inches wide and 2 inches thick, with the ends rounded and a half circle cut from the top, near the front end, very slightly larger than the motor. The clearance is for a cushion of rubber.

A piece of ⅛ inch thick, ¾ inch wide strap iron about 4½ inches long was bent to the shape shown and used to hold the motor in place. A piece of inner tube was laid beneath the motor, the strap iron screwed down, then the bolt inserted in the hole through the top, the nut being between motor and strap iron. By holding the bolt stationary and turning the nut, the motor is held very snug and rigid. This piece will vary in length and shape according to the motor you use.

Finding that the motor block is all right, the motor was removed and a ¾-inch hole bored diagonally from the rear end of the block to a point under the motor cut where another hole of the same size was bored to meet it. The handle is a 3-foot length of seamless steel electrical conduit pipe ¾ inch in diameter, outside measurement. This pipe was covered with best quality liquid glue and driven into the block as far as possible.

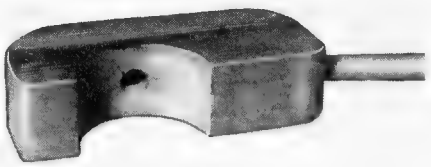


A suitable hardwood handle, 8 inches in length and with a maximum diameter of 1½ inches, was turned from a block of wood which first was bored from end to end until the point of the bit showed. A plug was tapped into the open end and sawed off and the live lathe center placed here, with the other end at the tail stock, and the piece was turned to the shape shown. This, too, was glued to the other end of the handle, being driven to a tight fit. Then the end hole was enlarged slightly and the 15-foot length of rubber insulated flexible cable was threaded down the pipe and out under the motor. The wires from the motor were soldered to the cord wires, the motor put in place and the slack pulled back up the handle. This completed the assembly save the drum, drum covering and the drum supports.

The drum just before removing from the lathe.

Above—The polisher in use. Note that only one hand is needed to guide it. Left—Close-up of the final assembly. The belt is a band cut from a heavy duty inner tube.

The drum itself is 5 inches in diameter and 8 inches long and has a ¼-inch wide groove cut ¼ inch from the right end for the belt. Fir was used but white pine or any other wood will do. The live and dead center marks were then bored about 1 inch deep to start the lag screws. Two ⅛-inch thick, 1¼-inch wide strap irons, 11¼ inches long were cut, drilled and bent to shape for the drum supports. Round head No. 10 screws 1 inch long, held the irons to the motor block and the 2½-inch long lag screws were used for axles. To prevent rubbing, one or two washers were placed each side of the strap irons over the log screws. Before the right-hand lag screw is put in place, cut the belt from a very heavy inner tube about ¼-inch wide and slip it in the drum groove and over the motor pulley.



The motor block. The hole bored in the back is for the supply wires.

Now plug in and see how it works. The ratio of the polisher shown was 10 to 1, which gave a normal drum speed of about 100, but up to 200 r.p.m. for the drum will be satisfactory. The motor used is especially convenient, save that it was a little undersized, since it has a (*Continued on page* 172)

New Tools You Can Easily Make

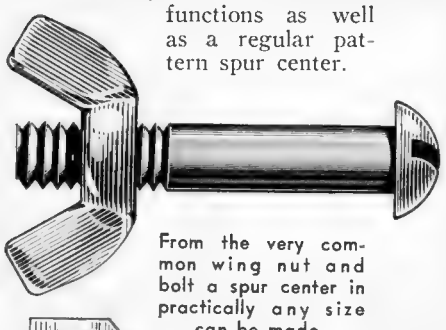
A Little Effort, Spare Time, and Easily Obtainable Materials Will Be Well Spent in the Production of Several New Tools. This Month We Feature a Novel Motor Mount, an Emergency Spur Center and a Handy Device for Power Tapping

By Joseph Pignone

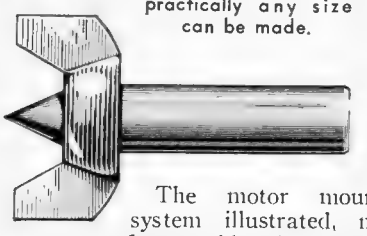
WHILE most of his pattern work is handled by a patternmaker, oftentimes the machinist is confronted with making a simple wood pattern himself. Customarily, the machinist takes a wood block, clamps it in the four-jaw chuck and proceeds: This is practical for solid patterns, but when split patterns of the simplest form are encountered complications arise. Using the face-plate and center is not always ideal, and purchasing or making a regular spur center is not always warranted by the amount of work handled.

The spur center illustrated may be easily and quickly made. Simply procure a bolt or screw of any diameter preferred, and a large wing nut. Saw off the screw head and face off that end of the shank. Then turn a point at the thread end of the bolt. The wing nut is then screwed up tightly to the end of the threads. On the larger sizes the wing nut may be pinned to the shank. Lastly, file the wing nut to the form illustrated and also file each wing to a sharp edge.

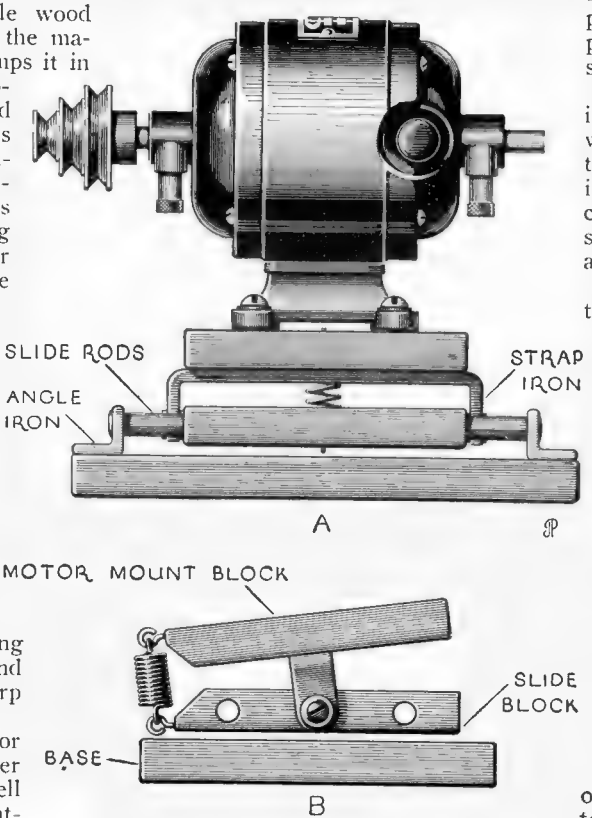
When mounted in a drill or scroll chuck, this little center functions as well as a regular pattern spur center.



From the very common wing nut and bolt a spur center in practically any size can be made.



The motor mounting system illustrated, might be considered unusual in that it permits of driving single pulley machines at three or four speeds, depending on the number of steps in the motor pulley. If, however, the machine to be driven is already provided with say a three-step pulley, then in conjunction with this improved motor drive it is possible to actually attain either nine or twelve speeds. This is easily accomplished, since the motor mounting block is pivoted and also slides along rods secured on a base. Sliding the motor block also assures of perfect alignment with the driven machine.



This motor mounting permits the belt to be shifted for speed changes and also assures proper tension and alignment.

Even were the speed change feature not necessary or taken advantage of, the arrangement of a pivoted drive motor still offers decided advantages over the conventional rigid mounting, especially for light, high speed transmission to machines subject to intermittent loads. Very frequently, unless conditions are ideal, round belting is inefficient for either of two reasons, either it is drawn too tightly when installed, or it has been stretched too loosely through usage. Since round belting seems to be most popular for light machines, a genuinely practical solution of its drawbacks should be welcome.

The arrangement suggested by the illustration prevents excessive bearing wear and power losses resulting from tight belts and overcomes the equally inefficient condition of loose belts. A correct compromise is effected by a suitably stiff spring to draw the motor away from the machine.

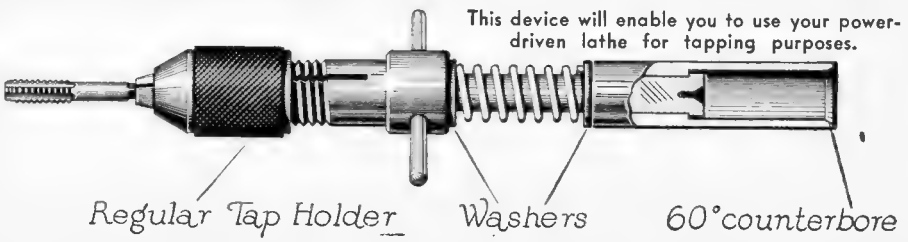
Another important possible adaptation for this unit is in connection with grinding operations in the lathe. The slide rods may be elongated and mounted on a backboard behind and over the bench lathe. This arrangement makes it possible to drive the conventional grinder which mounts on the slide rest, with greater ease than is ordinarily possible. It is to be remembered that slide rest grinders are required to function at various positions along the lathe bed, and this makes the drive belt problem a cumbersome one. The uniform belt tension that this unit assures makes it ideal for this purpose.

The details of constructing the device need not follow the illustrated ones, although if a light motor is to be used, constructing the base blocks of hard wood will be amply satisfactory. The angle irons, shown in the drawing, that support the slide rods may extend completely across the base block face, thus materially strengthening it; the base mounting bolts should pass through both irons and block. For average purposes, and for motors up to one-sixth horsepower, the suggested arrangement will prove very reliable.

One of the most unreliable operations connected with ordinary bench lathe work is hand tapping a true, cleanly centered thread with ordinary tools. Nothing short of a turret machine tapping attachment is really intended for this purpose.

For ordinary purposes, the conventional method of turning the work, by hand drawing the belt, and holding the tap with the other hand is tolerable. Some bench (*Continued on page* 174)

This device will enable you to use your power-driven lathe for tapping purposes.



Scientific Aids to Your Comfort

By Mary Jacobs

Cook While You Play

PLUG into the current supply and put in your meal—that's all you need do with one of these electric fireless cookers. Forget your roast, vegetable and pudding or cake till they are to be served. . . . The kitchen will remain cool, a decided advantage on these hot days.

For picnic and week-end motor trip use as well as indoor cooking, the vessel will prove handy. Once heated, even though the current is turned off, a fairly even temperature will be maintained for several hours. By the time you reach the countryside, lunch will be ready for you.

To make the carrying of it easy, a wooden handle has been provided, as well as an insulated lid that clamps on tightly with a bail lock. The cooker itself will withstand hard wear; it is chromium plated, 13⅝″ high and 10″ wide. The three compartments consist of a large round pan 6½″ × 7″ and two half-round ones 3½″ × 7″ each. Tested and approved in our laboratory.

Turns Itself Off

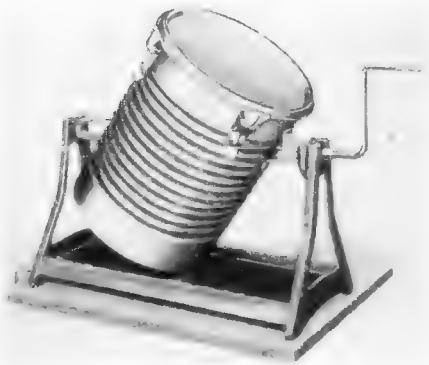
WANT to read yourself to sleep, secure in the knowledge that your lamp will be automatically turned off? Or the radio? Or some household appliance? Use an electric light switch that has a timing element. Just decide when you want the current turned off, set the toggle, and your will shall be done. This model will clock a three-minute period as accurately as it will a thirty-minute one; it can be set for any interval from three minutes to half an hour. Other models are adjusted for seconds and hours. Even in the laboratory it will be found a blessing for the electric soldering iron. Tested and approved.

Cooking by Weight

QUITE often you have trouble in following recipes accurately because they call for a cup or a few tablespoons of certain ingredients. The average kitchen scale gives a reading in pounds or fractions of pounds only. Here's a scale designed to take the uncertainty out of cooking. Its vari-colored dial tells you at a glance what the equivalent of a volume of staples (as milk, flour, shortening) is in ounces or pounds. A table of weights and measures, as well as cooking periods of meat and fowl are given. Tested and approved in our laboratory.

Range of Many Uses

THE latest model electric range, pictured here, provides: the well-known quick-cooking units, a smokeless broiler pan and an improved tray beneath the cooking platform to insure cleanliness, a shelf directly above the platform with a condiment set, an adjustable mirror, a warming compartment, a sloping switch panel with easy-to-read lettering, a towel rack, an electric clock for automatic operation, and either a seven-cup coffee percolator or a portable electric cooker.



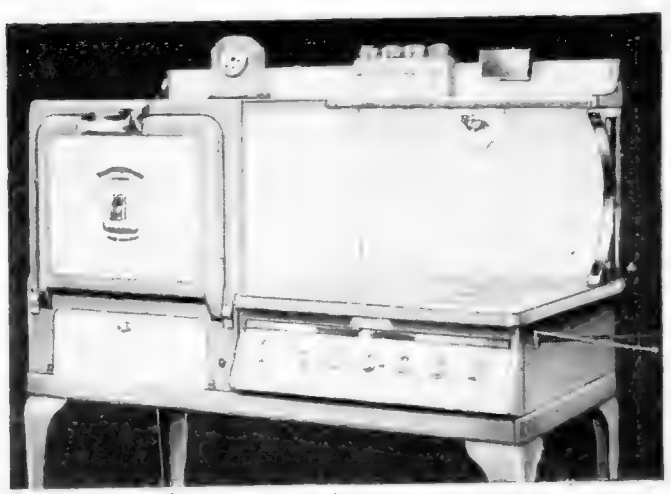
Keeping Garments Fresh and Dainty

MY, how cleaning bills do mount in warm weather. It seems that as soon as you don a freshly cleaned and pressed silk dress, it becomes wrinkled and messy because of moisture. Voiles and other delicate cottons actually wilt. What a strain it is to both your temper and pocketbook to keep clothes neat and dainty.

Why not economize and do the dry-cleaning of non-washable materials, and the washing of fine cottons yourself? Don't try to clean silks in gasoline, naphtha or other fluids which may explode unless carefully handled. Not only are they dangerous to handle, but they work havoc with your hands.

Simply place the garments and other materials to be cleaned in this container,

(*Continued on page* 180)

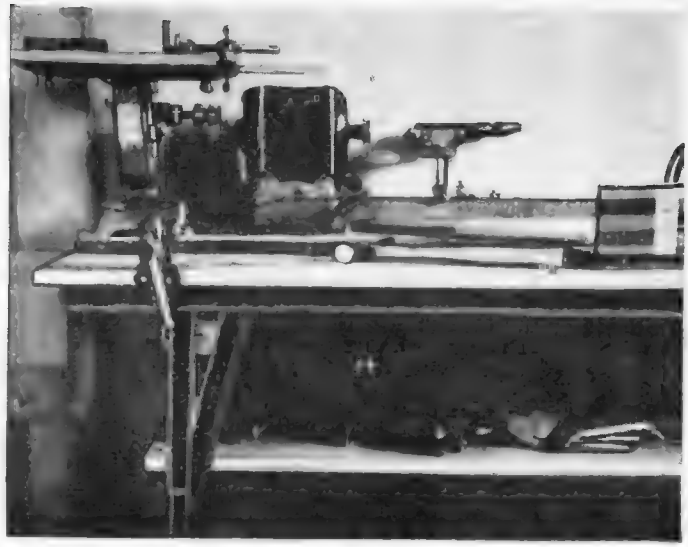


Name and addresses of manufacturers supplied upon request

A Workbench from an Old Bedstead

You Can Make the Workbench You Need So Badly from Scrap Iron Which You Will Be Able to Salvage from an Old Bed

By Charles H. Alder



The workbench provides ample working surface and also has a shelf beneath it where you can put materials you often use.

ABOUT the most essential thing in a workshop, outside of tools, is a good, sturdy workbench. Working on makeshift workbenches, kitchen tables and soap boxes is nearly as annoying and inconvenient as repairing a wrist watch on the floor. Kitchen tables serve as workbenches in many home workshops merely because so few realize how easily and inexpensively a first class workbench can be made.

Perhaps you needed more bench room or maybe you had just acquired one of the small motor-driven workshop outfits. You decided that a workbench would fill the bill. The first thing that you did was to price them in the tool catalogs and magazine advertisements. What happened? Your vision of a nice angle-iron workbench faded away; you felt blue and downcast. The ads ran like this: *ONLY* $10.00 *plus freight.* Some were more expensive. You couldn't afford one. So you hied yourself to the attic or cellar and dug out a rickety old kitchen table or something worse and are now using it as your workbench.

Now, isn't that right? Well, you can have that nice workbench for $1.60 plus a few hours of pleasant work making it. You will find its construction simple.

The first thing to do is to dig up an old bed, preferably one of the folding kind that people throw away after having made several valiant efforts to sleep on. The folding variety of bed is generally a mass of angle iron and one such bed will make a fine workbench. Old bed frames are just as good, but if you use bed springs you'll probably need two or more frames in order to get sufficient angle-iron of which to make a workbench. You can make your workbench of heavy or light material, as old beds can be found made up of different sizes of angle-iron. Where can old beds and old springs be obtained? Well, try the attic, the cellar, that empty lot near by, or a city dump. City dumps are, as a rule, chuck full of old beds and springs. A trip to a good size city dump is a real treat and quite fascinating, too.

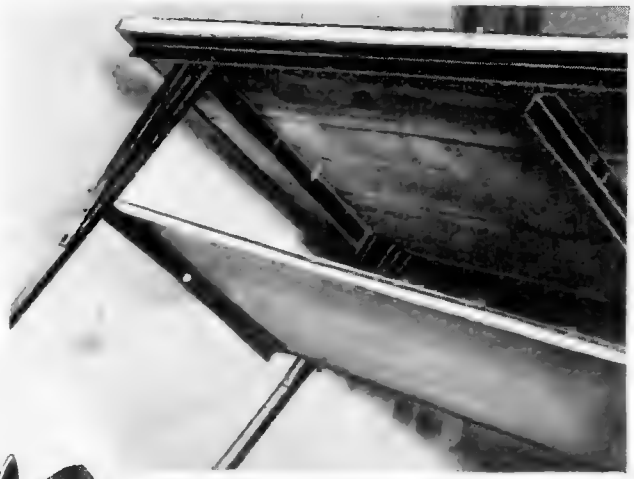
The method of bracing employed insures rigidity and prevents "see-sawing" when planing wood parallel to the long edge of the bench.

Take the bed or bed spring and study it thoroughly with the purpose in mind of figuring out the easiest way that a bench could be made from the particular bed that you have chosen. All beds are not made alike and some beds are constructed in such a way that very little effort is required to convert the bed into a serviceable workbench.

After you have decided just how you are going to utilize the material that you have, cut the angle-irons to the lengths that you want them, drill the necessary holes in the angle-irons, and then if the bed is rusty, wirebrush the pieces and assemble them with ¼" stove bolts. I suggest stove bolts because they give a nice appearance and have nearly flat heads. Use larger bolts if you use the larger sizes of angle-iron. My workbench is 31" in height; 6' long and 30" wide. The shelf is one foot lower than the bench top and is 5' long and 20" wide. I used 28' of 1"×10" lumber, and it cost me 5c per foot—$1.40. The stove bolts came to 10c and were purchased in the ten cent store and likewise was one can of black lacquer —*GRAND TOTAL*—$1.60.

The feet for the workbench were taken off the legs of the bed. Holes were drilled in the legs of the workbench and the feet were bolted on. To prevent your planes and other tools from

(*Continued on page* 177)



Note the length of angle iron cross-wise of the bench. It supports the center board and keeps it from sagging.

The little iron feet, one of which is shown, were taken off the legs of the bed and bolted to the legs of the bench.

For the Home Machinist

Another in the Series of Practical Suggestions . . . Improved Methods of Handling Screws, to Grind Parts Easily, to Do Vise Jobs and Make Fittings, for Working with Pipes and Other Round Parts, and for Measuring in Difficult Places, Are Detailed

By George A. Luers

Supervisor of Ordnance Design, Naval Gun Factory, Washington, D. C.

TIGHT screw bolts and slipping screw drivers do not help shop work. If a tight screw must be started, grip the work along with a short screw driver in the vise, as shown in Fig. 1, and with a wrench turn the screw driver. The vise will prevent slipping of the driver from the slot.

On large sized jobs, this procedure cannot be followed. A simple and serviceable method to hold the driver in the screw slot, is to put emery on the end of the screw driver. Dip the tool into coarse emery and the grip will defy hard turning without slipping. A small can of emery should be part of the screw driving equipment.

When work requires the use of wood screws, such as securing metal plates to hard wood, a good method is that of boring a small hole and using a half screw as a tap. The improvised tap cuts a thread and permits the insertion of the screw without danger of splitting even the hardest wood. The same technique is also advantageous for use on hard rubber or fiber, especially on electrical work where insulating material is to be secured.

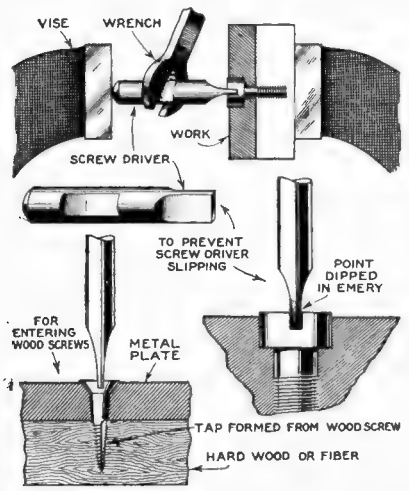


Fig. 1—Driving screws into metal, wood, hard rubber and fiber.

An unusual treatment for a grinding wheel is to fill the surface with paraffin or candle wax. This is an excellent practice when grinding brass or copper and prevents the wheel from filling with metal and glazing. The piece of paraffin or candle is held against the wheel while turning, as in Fig. 2.

The grinding of soft rubber is a job frequently required in the shop. To cut soft rubber rapidly, a wheel should be prepared as shown by grinding serrations in the edge by means of another wheel. The serrated wheel will cut soft rubber and other similar soft materials.

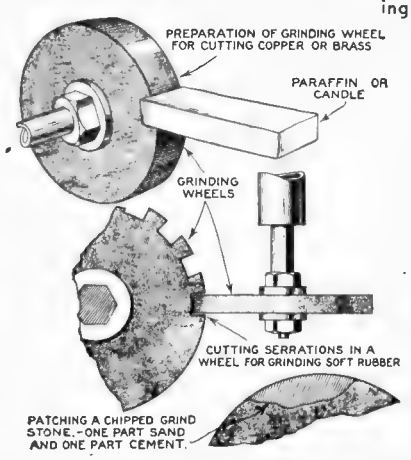

PREPARATION OF GRINDING WHEEL FOR CUTTING COPPER OR BRASS
PARAFFIN OR CANDLE
GRINDING WHEELS
CUTTING SERRATIONS IN A WHEEL FOR GRINDING SOFT RUBBER
PATCHING A CHIPPED GRIND STONE.-ONE PART SAND AND ONE PART CEMENT.

Fig. 2—Hold a paraffin candle against your grinding wheel, as it revolves, to prevent its filling with metal and glazing. How to repair a grindstone, and prepare emery wheels for grinding india rubber.

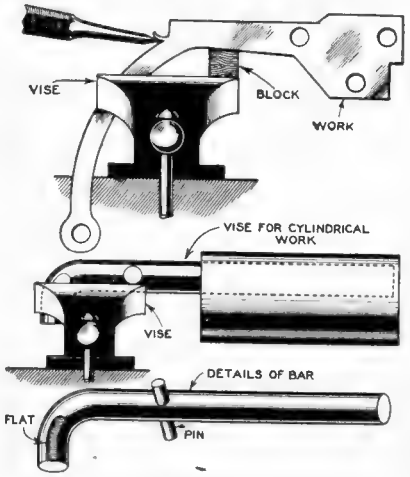


Fig. 3—A handy addition to the vise is the vise bar. It will hold long circular work in position, like a tinsmith's stake.

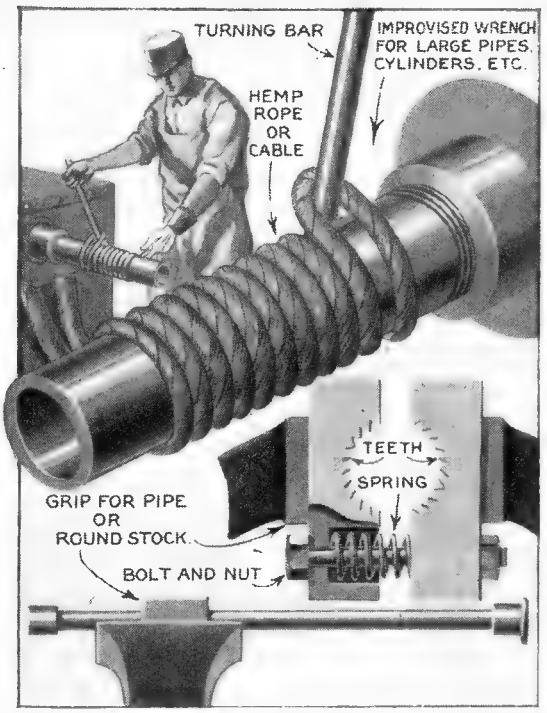


Fig. 4—Here we have an improvised wrench for working with large pipes or round stock, and grips for same.

Sometimes a grindstone is chipped by being dropped. The repair of a grindstone can be effected with a preparation made of equal parts of cement and sand. If the broken area is thoroughly cleaned and the patch set in, this will give excellent service.

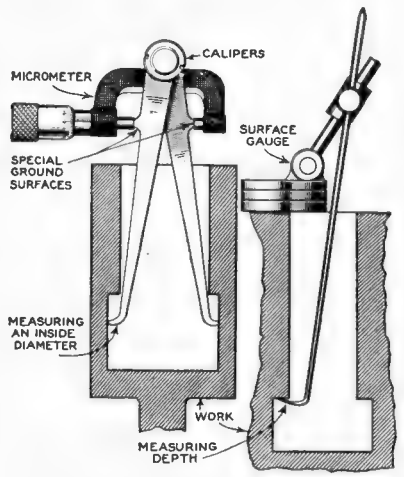


Fig. 5—Calipers and a micrometer will enable you to measure the diameter of a drilled hole accurately; a surface gauge, inverted into the hole will give its depth.

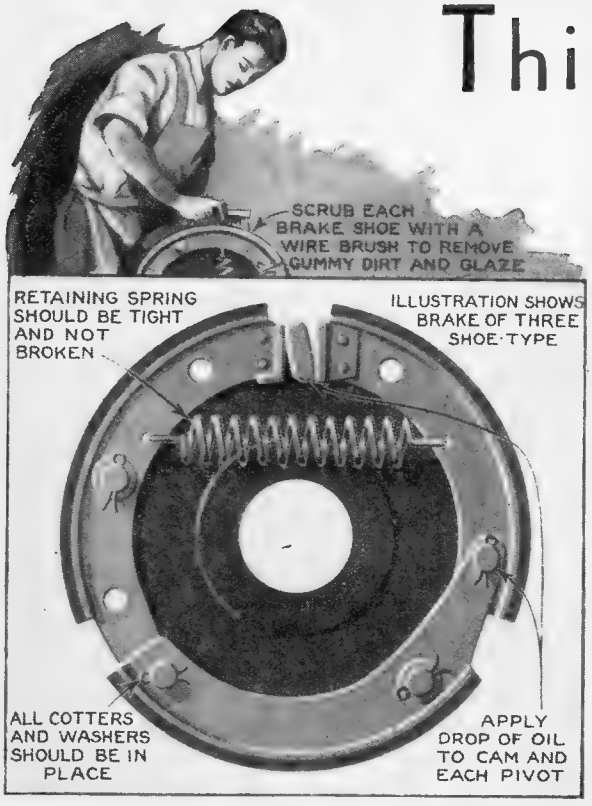
Gripping irregular work in a vise for chipping and fitting can often be best done by clamping one end and blocking the other. An arrangement to illustrate blocking is given in the upper view, Fig. 3. A piece so supported can be held rigid, while it may not be possible to hold the work by gripping alone. Sometimes the extended end can be carried by a block on the bench. Where gripping fails, try to hold the work in the vise jaws to prevent it turning. On long circular or tubular work, a vise bar or stake is useful. The form of

(*Continued on page* 185)

Things You Can Do For Your Car

Putting the Brakes in Good Condition, Checking Up on Steering Gear Connections, Adjusting the Horn, and Refinishing the Running Boards Are Important Elements in the Care of Your Car

By Arthur George, *Consulting Engineer*

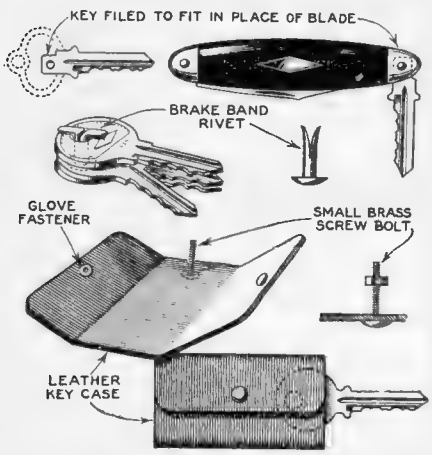

SCRUB EACH BRAKE SHOE WITH A WIRE BRUSH TO REMOVE GUMMY DIRT AND GLAZE
RETAINING SPRING SHOULD BE TIGHT AND NOT BROKEN
ILLUSTRATION SHOWS BRAKE OF THREE SHOE-TYPE
ALL COTTERS AND WASHERS SHOULD BE IN PLACE
APPLY DROP OF OIL TO CAM AND EACH PIVOT

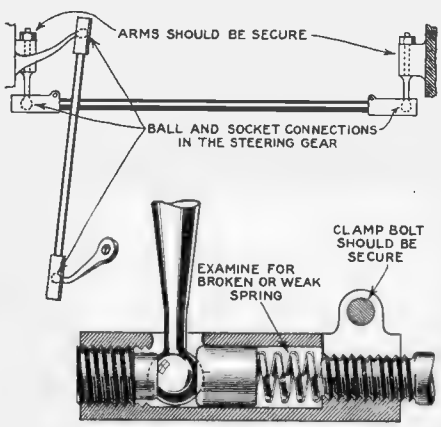
Follow these suggestions if you want your brakes to function smoothly.

FOR summer service it is essential that the brakes be in the best of condition. The small enclosed brakes of cars equipped with four wheel brakes usually collect gummy dirt because the oil in wheel bearings gathers dust and it collects on the brake lining. When the lining becomes glazed the grip is much reduced in strength, and it is almost impossible to make a quick stop. To condition the brakes, first remove the wheel. A steel wire brush is used to clean the surface of each section of the band. A slight amount of grease or oil is applied to the cam and each pivot pin. The tension of the retaining spring should be examined. If the spring is weak or broken, renew.

With a rag dipped in gasoline, clean the inside of the brake drum thoroughly. Wipe the surface of the drum and brake lining clean and dry, being sure that the lining has been thoroughly scoured with the wire brush. This treatment is equally as effective for woven lining, semi-molded or molded lining. The brakes should grip as well as new ones if they are not worn too thin.

Not only is the automobile key difficult to replace but the car is useless without the starting key. For this reason it should be attached to the other keys usually carried, or to some personal possession. A novel means used by one owner is to attach the key to his knife, as shown in the illustration. This was done by filing one end of the key to the shape of the pivoted end of a knife blade. Taking out the small pin in one end of the knife permitted him to insert the key in place of the blade. Another owner strings several keys on a small brake-lining rivet, through the eyes of the keys, as shown in the illustration. He has a rattle-proof holder that is not at all bulky to carry in his pocket.



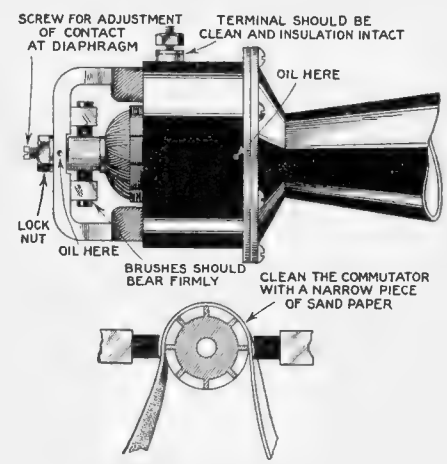

ARMS SHOULD BE SECURE
BALL AND SOCKET CONNECTIONS IN THE STEERING GEAR
CLAMP BOLT SHOULD BE SECURE
EXAMINE FOR BROKEN OR WEAK SPRING

The vital points in steering-gear parts and their adjustment. To the left—Any one of these methods will keep your automobile keys just where you can always get at them.

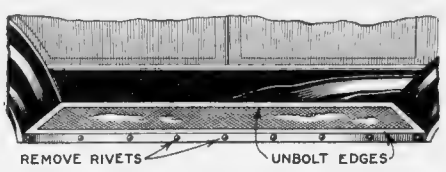
A small piece of leather, with a glove fastener, plus a very small screw is the method used by another owner. The leather folds twice and the glove fastener keeps the folds shut. The brass screw is long enough to pass through the number of keys that are to be carried in the holder. A small brass nut is placed on the screw and the end is riveted slightly. The details of this neat case are shown in the attached sketch.

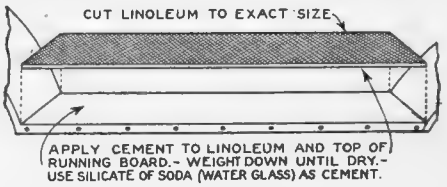
Excessive wear of the ball-end bearings and sockets or seats without compensating adjustment makes any steering gear dangerous. Recently the writer saw an accident caused by one of the ball connections in the steering gear linkage dropping out. The vital points in the steering gear linkage and a section through one of the connections are shown in the attached sketch. About

(*Continued on page* 182)

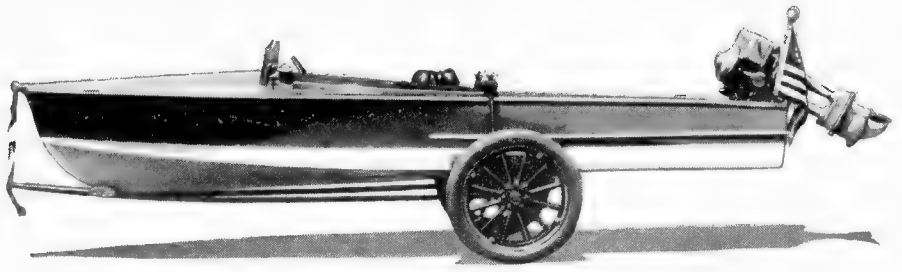

SCREW FOR ADJUSTMENT OF CONTACT AT DIAPHRAGM
TERMINAL SHOULD BE CLEAN AND INSULATION INTACT
OIL HERE
LOCK NUT
OIL HERE
BRUSHES SHOULD BEAR FIRMLY
CLEAN THE COMMUTATOR WITH A NARROW PIECE OF SAND PAPER

An oil can, sand paper, a screw driver, and a wrench enable you to keep the motor-driven horn in A1 condition.




CUT LINOLEUM TO EXACT SIZE
APPLY CEMENT TO LINOLEUM AND TOP OF RUNNING BOARD.- WEIGHT DOWN UNTIL DRY.- USE SILICATE OF SODA (WATER GLASS) AS CEMENT.

There will be a great difference in the appearance of your car if you occasionally renew the linoleum on the running board.



This photograph shows the trailer carrying a Mullins boat weighing 450 pounds, and an Evinrude motor weighing 110 pounds.

An Outboard Trailer for $14.50

By J. Phillips Dykes

DUE to many requests for plans and description of a cheap though practical and husky trailer—here are the plans for one that will cost you not more than $15.00 complete and ready to go, and suitable for any type of outboard boat.

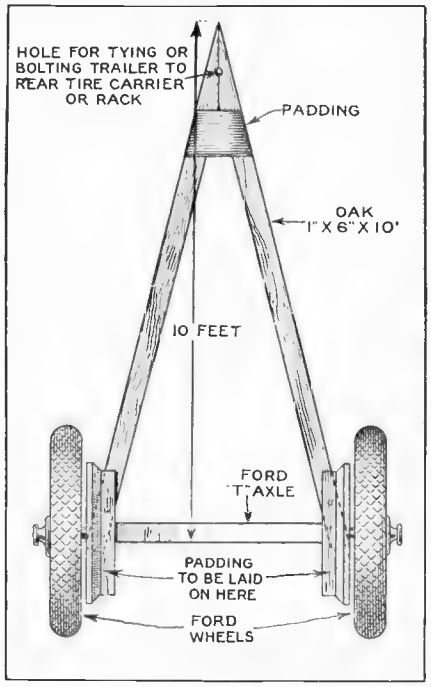
First go to a junk yard and buy a Ford front axle and set of wheels. Don't give the man more than $6.00 for these, and see that the wheels have good bearings in them. Then go to a blacksmith's shop and have the front pinions welded, but see that the wheels are carefully lined up before this is done. At this same blacksmith's shop you can have two iron rods threaded which you use to clamp the boat down, and which will be described later. $3.50 goes at the blacksmith's shop. Next stop at a lumber yard on the way home and get two pieces of 1″×6″ dressed oak, 10 feet long, four pieces 2 feet long, and one piece 5 feet long. Another $2.50 gone. Then stop at a hardware store and get six wagon bolts 4 inches long. Stop at a tire shop or garage and pick up some second hand Ford casings for $1.00 apiece and tubes for $.50 apiece, and you are ready to go home and spend two hours putting your trailer together.

Form your two long pieces into a V, the closed end being overlapped and screwed together with a ¾ inch hole in the board through the thickest part of the junction. The other end of the V should be just wide enough to fit in between the two wheels and the axle. The four carriage bolts are then fastened, and a piece of strap bound around the axle to hold the 1″×6″ pieces down tightly on the axle. Two of the short wooden strips are nailed together in trough form and are bolted down to the wooden tongue on each side. A hole is then bored in each strip, and the iron rod is passed through there. The lower end of it is bent around the axle, and the upper end is high enough to reach above the sides of your boat. (See photograph.) These two troughs on each side are padded with burlap, the front of the V tongue is padded, and the boat is set on the trailer.

Then holes are bored at the proper place in the 5 foot timber, and the two extra nuts tightened down on this, holding the center of the boat securely. The front of the boat is tied securely to the tongue by the painter. Then your trailer is either roped to your spare tire rack or else bolted, and you are ready to go.

The one thing necessary to remember is to clamp and rope the boat down tight and see that your tongue is long enough to put the balance of weight forward of the axle of the trailer. The engine may be removed to avoid strain and help the balance.

Working plan of the boat trailer, which can be built in two hours by unskilled labor.


HOLE FOR TYING OR BOLTING TRAILER TO REAR TIRE CARRIER OR RACK
PADDING
OAK 1" X 6" X 10'
10 FEET
FORD T AXLE
PADDING TO BE LAID ON HERE
FORD WHEELS

Get your

RADIO TRAINING

From America's finest Radio School

THE man who really wants to become an expert in radio . . . who knows that the better his foundation, the better his chances . . . and who is willing to spend a year preparing himself . . . such a man will make no decision until he has read the complete story of RCA Institutes, Inc.

A Good Foundation Vital

Like other professions, radio rewards only those who excel. The poorly trained will never rise higher than the place in which they started. Others will climb step by step to positions of power in radio telephony . . . broadcasting . . . sound pictures . . . aviation radio . . . radio merchandising. And among these will be those who planned years in advance . . . studied, worked, stuck to it.

You are making your decision right now, how well you will fit yourself. So decide wisely. To be a graduate of RCA Institutes stamps you as a man who knows the real worth of a good foundation. As one who knows that a year of training now, under America's finest radio instructors, is the surest way to acquire the knowledge and skill you must have.

You Can Study At Home

You do not have to give up your present position to enjoy the benefits of RCA Institutes training. You may study at home in your spare time . . . or at any of our resident schools throughout the country. The Home Laboratory Training Course includes a complete set of radio equipment of the most modern design.

Send For Our Free Book

If you have read this far . . . you have already indicated that you are the type of man who should study radio. This may be the big turning point of your life. You will not rest until you have sent for our free book that tells you the complete story of what RCA Institutes offers you. Fill in and mail the coupon below right now. There is plenty of time for investigation . . . but no time for delay in getting all the vital facts.

RCA INSTITUTES, Inc.

RCA INSTITUTES, Inc.
Dept. EX-6
75 Varick St., New York, N.Y.

Gentlemen: Please send me your FREE book which tells about your laboratory method of radio instruction at home.

Name.....

Address .....

.....

Occupation .....

PATENTS SECURED
TRADE-MARKS REGISTERED

High-class professional services for Inventors and Trademark users are necessary for Proper Protection. We offer you our facilities on reasonable terms. If you have an invention send us a model or sketch and description and we will give you our Opinion whether your invention comes within the provisions of the Patent Laws. Our book "HOW TO GET YOUR PATENT" and Record of Invention Certificate sent on request. *Delays* are *Dangerous* in *Patent Matters*. We Assist our Clients to Sell Their Patents. TERMS REASONABLE. BEST REFERENCES.

RANDOLPH & CO.
PATENT ATTORNEYS
Dept. 172, Washington, D. C.

Name .....

Street .....

City .....

UNPATENTED IDEAS CAN BE SOLD

I tell you how and help you make the sale. Free particulars. (Copyrighted)
Write W. T. Greene
926 Barrister Bldg., Washington, D. C.

INVENTIONS PROMOTED

Patented or Unpatented. In business over 30 years. Send drawing and description or model, or write for information. Complete facilities. References.
ADAM FISHER MFG. CO., 205-D, Enright, St. Louis, Mo.

PATENTS

Write for Free Information, HOW TO OBTAIN A PATENT and RECORD OF INVENTION—or send drawing or model for examination.
MILLER & MILLER, Patent Attorneys
Former U. S. Patent Office Examiners
Dept. C, 1006 Woolworth Bldg., N. Y. City
261 McGill Building, Washington, D. C.

PATENT YOUR IDEAS REGISTER YOUR **TRADE-MARK** BY
Z. H. POLACHEK
1234 BROADWAY 31st. NEW YORK
REG. PATENT ATTORNEY PROF. ENGINEER
WHAT IS YOUR INVENTION?
Send me a simple sketch or a model for Confidential Advice—Do It Now!

PATENTS

TRADE MARKS COPYRIGHTS
LOW FEES
PARTIAL PAYMENT PLAN
SEND SKETCHES AND DESCRIPTION NOW
OR
WRITE TODAY FOR FREE BOOKLET
HARRY W. JOHNSON,
FORMERLY U. S PATENT OFFICE EXAMINER
910 G Street, Washington, D. C.

PATENT ADVICE

CONDUCTED BY JOSEPH H. KRAUS

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail, a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

Motion Picture Projector

(1264) Mr. Robert J. Hill, Dayton, Ohio, inquires whether he could sell an idea or conception of an improvement to the motion picture projector.

A. Because of financial reasons, you cannot get a patent on the same. When one deals with one's fellowman, it is very often necessary to trust him. The only thing which you can do under the present circumstances would be to try to establish as many claims of priority for the idea as is possible. We also suggest that you have a photograph taken of the improvement and have it attested by a notary. Then carry on whatever correspondence you may find necessary with various individuals who present a most likely market and take a chance on revealing the idea. Keeping it a secret is of no value to you nor to the industry.

We believe that you can take a reasonable chance in any transactions if there is no means or method whereby you can protect the idea by a patent.

Foot Valve Control

(1265) Mr. C. C. Mills, New York, N. Y., suggests an automatic foot valve release for faucets on wash basins and combination calendar and clock.

A. The application of an invention to a different purpose is rarely a claim for a patent. There are many valve releases now that are operated by the feet. While but a few of these have been applied to wash basins, there is no reason why they could not be so applied. Inasmuch as you have given no description of your construction, it is impossible for us to specify whether or not you can secure a patent on the same.

The same reasoning holds for the clock and calendar combination. There are such combinations on the market today. You will have to be more specific in your details before we can advise on the possibility of a patent.

Perpetual Calendar

(1266) Mr. H. A. Frederick, New Rochelle, N. Y., has submitted an answer to inquiry No. 1207, of Edward Fegan, Cincinnati, Ohio. It will be remembered that Mr. Fegan requested patent advice on a perpetual calendar to fit on the end of a fountain pen.

A. Mr. Frederick's patent was taken on July 26, 1928, number of which is 1,721,337. The calendar is set once each month. It is not bulky and the figures are large enough so that they can be seen without a glass. The figures are staggered on the barrel and the invention provides that the device can be made either as an attachment to or an initial part of the fountain pen.

This communication from Mr. Frederick upholds our stand.

A Washing Solution

(1267) Mr. G. S. Bunch, South Bend, Indiana, asks whether he would be infringing on a patent or whether he could patent a solution of hand soap, washing powder, ammonia and some essential oil for odor.

A. There is nothing patentable in this mixture. Many of the cleaning and washing fluids today are substantially the same as the one you have outlined. You could undoubtedly develop a market for the product, labelling it, bottling it and selling it through your own agency. You could get a trade mark on the label registered.

Auto Headlight

(1268) Mr. Paul Eugene Duplain, Ancienne-Lorette, Quebec, P. Q., Canada, requests our opinion of a headlight for automobiles.

A. Practically every headlight recently invented has had for its object the prevention of glare. Very few headlights seem to live up to the object. We hold that there is a good market for a headlight that will illuminate the road as completely as any of the glaring types now do and that will present as interesting a design as the present-day styles.

Unfortunately, headlights do not enjoy the same sale today as they did years ago. The reason for this is that the manufacturer of automobiles has made as many advances in headlight design as the average inventor makes. The headlights match the color of the car. We scarcely believe that any man would put headlights on his car for the expressed purpose of preventing a glare in someone else's eyes. If all automobiles did so, then there would be no excuse for the one who possesses glaring lights, but in view of the fact that the average automobilist is primarily concerned with himself and not with the oncoming motorist, we doubt if he would go to the expense of purchasing headlights which were even guaranteed to be glareless.

Your chances for sale of such an idea rest with your automobile companies. If your product is really worth while, some large manufacturer may be glad to purchase the invention, either outright or on the royalty basis.

At the right is a view of my drafting and specification offices where a large staff of experienced experts is in my constant employ.

PATENTS

All drawings and specifications are prepared in my offices.

My Offices Just Across Street From U. S. Pat. Office

Protect Your Ideas

Take the First Step Today—Action Counts

If you have a useful, practical, novel idea for any new article or for an improvement on an old one, you should communicate with a competent Registered Patent Attorney AT ONCE. Every year thousands of applications for patents are filed in the U. S. Patent Office. Frequently two or more applications are made for the same or substantially the same idea (even though the inventors may live in different sections of the country and be entirely unknown to one another). In such a case, the burden of proof rests upon the last application filed. Delays of even a few days in filing the application sometimes mean the loss of a patent. So lose no time. Get in touch with me at once by mailing the coupon below.

Prompt, Careful, Efficient Service

This large, experienced organization devotes its entire time and attention to patent and trademark cases. Our offices are directly across the street from the U. S. Patent Office. We understand the technicalities of patent law. We know the rules and requirements of the Patent Office. We can proceed in the quickest, safest and best ways in preparing an application for a patent covering your idea. Our success has been built on the strength of careful, efficient, satisfactory service to inventors and trade-mark owners located in every state in the Union.

Strict Secrecy Preserved—Write Me in Confidence

All communications, sketches, drawings, etc., are held in strictest confidence in strong, steel, fireproof files, which are accessible only to authorized members of my staff. Feel free to write me fully and frankly. It is probable that I can help you. Highest references. But FIRST—clip the coupon and get my free book. Do THAT right now.

No Charge for Information On How to Proceed

The booklet shown here contains valuable information relating to patent procedure that every inventor should have. And with it I will send you my "Record of Invention" form, on which you can sketch your idea and establish its date before a witness. Such evidence may later prove valuable to you. Simply mail the coupon and I will send you the booklet, and the "Record of Invention" form, together with detailed information on how to proceed and the costs involved. Do this NOW. No need to lose a minute's time. The coupon will bring you complete information entirely without charge or obligation.

Clarence A. O'Brien

Registered Patent Attorney

Member of Bar of: Supreme Court of the United States; Court of Appeals, District of Columbia; Supreme Court, District of Columbia; United States Court of Claims.

PRACTICE CONFINED EXCLUSIVELY TO PATENTS, TRADEMARKS AND COPYRIGHTS

Inventors *Write for these* Free Books

Mail this Coupon Now

CLARENCE A. O'BRIEN

Registered Patent Attorney

53-H Security Savings & Commercial Bank Bldg., Washington, D. C.

—or—

Suite 1106, Dept. D-12, Woolworth Bldg. New York City

Please send me your free book, "How to Obtain a Patent," and your "Record of Invention" form without any cost or obligation on my part.

Name.....

Address.....

.....

(Important! Write or print plainly, and address office nearest you)

PATENT PROTECTION

WITHOUT cost, WITHOUT loss of time, WITHOUT disclosing to anyone even to us. THIS FREE BOOK TELLS HOW! Write for your copy TODAY.

NO WONDER THEY FAIL!

INVENTORS—Don't expect your Patent Attorney to protect you unless you take measures to protect yourself!

BERNARD & HELLER
31 EAST 17TH ST. NEW YORK

INVENTORS FINANCE CORPORATION

Will advance part of your necessary expenses, thus avoiding the danger of delay in filing application for patent, arranging for the repayment on a time basis.

UNION TRUST BUILDING
WASHINGTON, D. C.

Chicago representative—N. E. HEWITT
Room 1853, 111 West Washington Street

MAIL THIS COUPON NOW

INVENTORS FINANCE CORPORATION
Dept. C, Union Trust Bldg., Washington, D. C.

Please send me particulars with reference to above plan, and information about the way to proceed.

Name.....

Address.....

City.....State.....

PATENTS

BOOKLET FREE HIGHEST REFERENCES
PROMPTNESS ASSURED BEST RESULTS

Send drawing or model.

WATSON E. COLEMAN, Patent Lawyer
724 9th Street, N. W., Washington, D. C.

PATENTS—TRADE MARKS

All cases submitted given personal attention by a member of the firm.

Information and booklet free

LANCASTER, ALLWINE & ROMMEL
255 Ouray Bldg., Washington, D. C.

To Learn Write

Begin Today—Write for My FREE BOOK. I can make a good penman of you at home during spare time. Write for my FREE BOOK, "How To Become a Good Penman." It contains specimens and tells how others mastered penmanship by the Tamblyn System. Your name will be elegantly written on a card if you enclose stamp to pay postage. Write today for book.
F.W. Tamblyn, 424 Ridge Bldg., Kansas City, Mo.

ELECTRICAL ENGINEERING

Complete Course in One Year

A CONCISE, comprehensive course in Electrical Engineering for ambitious young men of limited time to prepare them for the opportunities offered in the electrical field. 38 years' experience assures you maximum training in minimum time.

Theory and Practice Combined

Theory and practice are closely interwoven in classroom and laboratory. Mathematics, Engineering Drawing and Intensive Shop Work. Students construct motors, install wiring and test electrical machinery. Fireproof dormitories, dining hall, laboratories and shops.

Bliss Men are in Demand

and hold responsible technical and executive positions. Catalog on request.

BLISS ELECTRICAL SCHOOL
146 Takoma Ave., Washington, D.C.

Among the Inventors

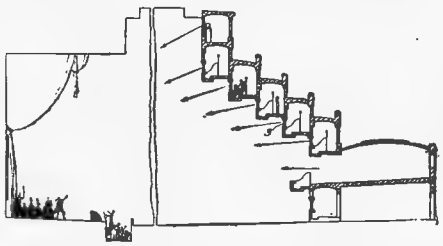
Notice to Readers:

AN appreciable period of time elapses between the filing of a patent and the date upon which the patent is granted. During this interval inventors frequently move. We regret that it is quite impossible for us to supply the correct addresses of persons whose inventions appear on this page, nor can we furnish information about when the product may appear on the market. Attorneys who prosecuted the patent cases can furnish the most reliable data. Copies of patents are available at ten cents each from the U. S. Patent Office, Washington, D. C.

All Seats in Theatre Equi-distant from the Stage

THEATRES are so constructed nowadays that not only do those in the rear seats suffer the disadvantage of viewing the stage at an angle but they must also be content with being stationed at a much greater distance from the scene of action than the folk up in Row A.

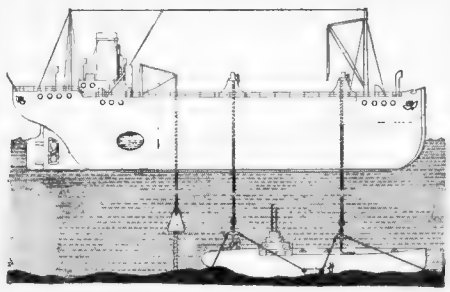
Two very democratic gentlemen, Luciano Chersanaz and Gillermo Alvarez would place everybody at the same distance from the stage. Here's how they plan to do it. Instead of having the rows of seats recede from the first row, they would place the second row higher and in front of the first and the third over and in front of the second. In this way as the vertical distance from the stage increases the horizontal decreases thus tending to offset each other. The patent number is 1,787,184.



Salvage Ship Built on Pontoons

IN the last few years there has been an increasing need for a salvage ship which possesses sufficient buoyancy to be able to provide a base for heavy duty cranes for deep sea bottom operations. Many of us can still recall the submarine disasters in which attempts were made to hoist the disabled vessels to the surface. Most of us remember that the salvage ships just heeled over and were unable to exert the necessary lifting effect.

Mr. Wortman plans, in patent number 1,776,210 *to build a ship which would be essentially two monster pontoons joined fore and aft. In the center of the boat there would be an open well through which the hoisting cables would pass. He feels that such a structure would have maneuverability, seaworthiness and at the same time provide a suitable base of operations for salvaging proceedings.*

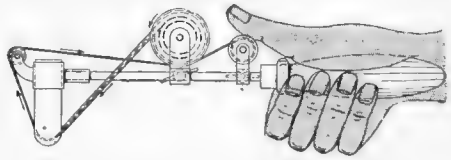


Liquid Identification

IT is often most difficult to identify liquids especially when one is handling several different grades of the same substance, such as motor oils. To prevent mistakes and enable one to determine immediately what material he is pouring, Mr. Frank C. Reilly would distribute symbols, such as letters or numerals throughout the liquid. The markers should be of about the same specific gravity as the fluid so as to remain in suspension and flow freely with the liquid. The characters would distinguish the grade and kind of substance being used. Of course the markers should be of such material that they will not affect the containing fluid. The patent number is 1,787,995.

Self-Feeding Soldering Iron

HOLDING your work with one hand, and soldering with the iron held in the other is not always so easy. To simplify matters and incidentally to speed up production a soldering iron has been designed in which the solder is automatically fed to the heating unit.



The solder, in strip form, superimposed upon a wire, is rolled upon a reel. As this reel is unwound the strip passes through a groove in the heating unit. Here the solder is melted and drips from the wire to the work. The wire is then wound upon a second reel. This reel is turned by the thumb of the hand which holds the device. In this way positive control of the speed of the feed is always assured. Mr. Orenstein is the inventor and the patent number is 1,783,134.

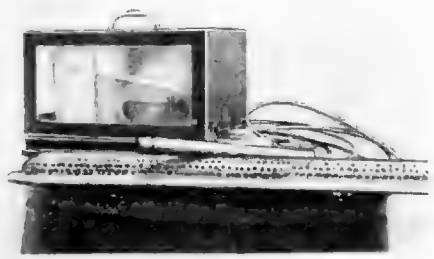
Long-Range Weather Forecasting from the Ocean

(*Continued from page* 108)

southern Peru, as well as certain portions of the African West Coast, owes its well-defined dry summers to the control of a high-pressure wind system over the ocean to the west of it. That such effect, however, is not confined to rainfall alone but to some sort of temperature control as well is evident. Thus, the climate of San Diego is exceedingly equable, both the daily range in temperature and the annual range, being less than that of a region of the same altitude and a relatively short distance inland, such as Los Angeles or Santa Ana.

The discovery of the effect of ocean temperatures on climate was made by the Coast and Geodetic Survey in connection with research dealing with the Gulf Stream. This research, incidentally, has exploded the myth that by altering the course of the Gulf Stream the winter climate of the northeastern part of the United States can be moderated.

Meteorological research, according to H. A. Marmer of the Survey, shows that the tempering influence of the Gulf Stream on the climate of northwestern Europe is effected through the agency of winds. In winter the winds there are prevailingly from the southwest. Blowing over the relatively warm water which the Gulf Stream has brought to the northeastern rim of the Atlantic, they carry warm air onto the coast. It is through this mechanism that the heat exchange in winter between the Gulf Stream and the air of northwestern Europe takes place.



A jacketed thermometer which is fastened to the hull of a ship and a thermograph with which a continuous record of ocean temperature is obtained and recorded.

The measure of the influence of the Gulf Stream on the climate of northwestern Europe is shown, Mr. Marmer says, by the fact that the average temperature for the month of January in northern Norway is about 45 degrees above the January temperature normal elsewhere for that latitude. Hammerfest, on the north coast of Norway in latitude 70° 40″ N.—well within the Arctic Circle—is an important harbor and seafishing center during winter, while the port of Riga, on the Baltic, about 800 miles farther south, is obstructed by ice throughout the season.

Mr. Marmer believes that recent investigations in long range weather forecasting indicate the possibility of correlating the fluctuations in the temperature and the course of the Gulf Stream with resulting climatic effects in Europe. Plausibility has been given this reasoning by the fact that the date when spring plowing can commence near Upsala, Sweden, may be predicted two months in advance by measuring the temperature of the water of the Atlantic off the coast of Norway. It has been learned, also, that the summer temperature of the water in the region between Newfoundland and Ireland gives an indication of the rainfall in Ireland and Great Britain the following year.

Climate Depends on Winds

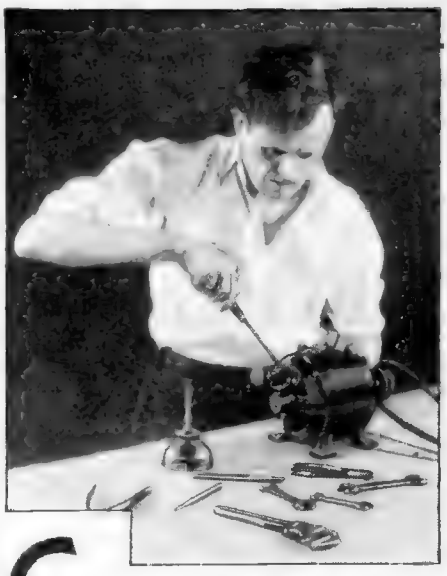
Aside from latitude, the climate in the northeastern part of the United States depends mostly on the direction from which the winds come and the force with which they blow. In the winter the winds along the northeastern coast are prevailingly from the northwest, that is, from the land. It follows that the warm waters of the Gulf Stream lying several hundred miles to the leeward can in no way moderate our winter climate. The climate could be moderated only if the winter winds could be made to blow from the south or the southeast.

Indeed, Mr. Marmer points out, there are good reasons for believing that if the Gulf Stream were to shift closer to the coast the climate of the Northeastern States would become more extreme rather than moderated—colder and more stormy in winter, hotter and more humid in summer.

Research by the Carnegie Institution and the University of California has demonstrated also that the cause of fog on the West Coast is linked closely with the relationship between land and water temperatures. New rules for predicting the formation of fog along the Pacific Coast are being developed on the basis of meteorological data on the Pacific Ocean and information concerning water temperatures and currents. A general rule for predicting fog has been developed, as follows:

"Whenever a condition arises in the San Diego district which gives a south or southwest wind, and there is an inversion of temperature aloft of 15 degrees greater than at the surface, fog and low-lying stratus clouds may be predicted." Heretofore, this rule has been usable only for a small portion of the time inasmuch as the prevailing winds in the vicinity during the summer are west and northwest.

Predictions of seasonal temperature on the West Coast will be of vast economic importance to many industries—to agriculture, to suppliers of fuel for domestic heating, and to producers of hydro-electric energy. Farmers will be able to determine plowing dates in advance, and orchardists to plan economically the protection of fruit groves against frost.



CHEAP OIL
is poor company
for good tools

You are careful to choose good tools for your workshop. Be just as careful about the oil you use. Good tools soon become poor tools in the company of cheap oil.

To keep tools and shop equipment *working* right and *looking* right, there's nothing quite so good as 3-in-One Oil. It costs a little more than plain mineral oils, but it *does* more. As it *oils,* it also *cleans* and *prevents rust.*

To do these three important jobs at one time, 3-in-One is blended by a special process from *animal, mineral* and *vegetable* oils. Used regularly, 3-in-One Oil saves many a bill for repairs and replacements. Both handy cans and bottles; all good stores. Write for free sample today.

THREE-IN-ONE OIL CO., DEPT. 413
170 Varick St., New York City
260 Second Ave., Ville St. Pierre, Montreal, Que.

3-in-One Oil
CLEANS - OILS - PROTECTS

This Department Is Conducted By and For You. Expressions of Opinion or Comments Are Welcome. Please Address Them to Safety Valve Editor, in care of this publication.

Discovery—A Cure for the Common Cold

I READ the letter in the current number about a prize being offered for a cure or prevention for the common cold.

Your correspondent is probably a regular reader, and in that event this letter may be of interest to him. It might point the way for investigators along that line also.

I am not a physician but one who has raised a family of children and has had plenty of opportunity to observe disease and ailments and the varying degrees of inelligence of medical men in practice.

To make a long story short, I observed many years ago that alkaline substances, for instance, baking soda, had a beneficial effect in checking colds and in assisting the cure. This would mean that an acid condition favored contracting and development of the disorder and the common procedure of the medical man would be to apply or prescribe some anti-acid as a cure. This is in line with medical philosophy. Eliminating causes is the last thing they think of. Consequently medicine amounts to finding some sort of chemical "saviour" or "redeemer" upon which the sinner (sufferer from disease) can cast his burden and be vicariously regenerated.

The rational method is to find what causes acidity, which makes the nutrient feeding ground for the elusive "cold germ," and having found the cause, eliminate it. You may be sure that germs of any kind cannot live in a medium that does not offer "good eating" for them.

The tip I am offering your correspondent and also the medical and germ hunters, is this. The ordinary everyday diet of civilization leans too much toward acid forming foods. This provides the seed bed, and fatigue or sudden temperature changes affecting first the lymphatic structures of the body acts to cause congestions and the congestions result in the common cold symptoms.

I have noticed that recent experiments by medical men tend toward neutralizing acidity, but their practice rests with having found a neutralizer or "cure," and in practice this will simply result in another "vicarious saviour" upon which the patient will depend. The ultimate result will be that the functions of the body will resort to other means to purify itself and will manifest them as some new disease. Then the hunt for a new germ will begin again.

GEO. H. LONG,
Cleveland, Ohio.

(There are hundreds of physicians who read SCIENCE & INVENTION *regularly. We feel confident that some of them will comment on the "Baking Soda Cure" for the common colds.*—EDITOR.)

Billion, Not Million

I WISH to call your attention to an error in your article entitled "A Billion Dollar Business in Junk," contained in the November, 1930, issue of SCIENCE & INVENTION. This error appeared in a release by the Bureau of Mines and was later corrected, after we called their attention to it. The total consumption of scrap annually is estimated at thirty million tons of scrap iron and steel, valued at one and a half billion dollars, instead of thirty thousand tons, valued at one and a half million dollars, as quoted in your article.

JOSEPH COLVIN,
Institute of Scrap Iron & Steel, Inc.
New York City.

(We regret very much that this error has occurred and we are glad to make the correction.—EDITOR.)

From Across the Pond

I AM writing this letter to tell you what a wonderful magazine you have in SCIENCE & INVENTION. I have just read September, October and November 1930 issues and can only say how interesting and useful they are.

I think America is farther advanced in these matters than we are. You cannot obtain an English magazine such as the above, so we buy yours. England, although the center of the world is a long way behind the times as far as SCIENCE & INVENTION in general is concerned. How lucky the Americans are, just able to write for plans of gliders, boats, etc., when we have only now started our first Gliding Club run by amateurs. Wishing your magazine every success.

BERNARD RATCLIFFE,
Ecclesall, Sheffield, England.

An Astounding Discovery

IF you are the least interested in making an astounding discovery, you will investigate the report from Lewiston, Idaho, December 25, 1930, that a bright light passed with great speed through their skies, succeeded by a terrific crash. Don't hesitate but find out about it. It will likely astound everyone.

A FRIEND

(Has anyone anything to report on these supposed phenomena? We shall be glad to hear from our readers.—EDITOR.)

Wants Mathematics

I HAVE been an intermittent reader of SCIENCE AND INVENTION for the past few years, but I shall positively "settle down" to it now. I found the articles in it splendid and am especially enthusiastic about C. H. Chittenden's proposal for a Mathematic Curiosity Department. His own example has an obvious answer. I need only refer him to Ball's "Mathematical Recreations."

The problem given by S. A. Sloan is a bit interesting but hardly difficult. I first state it. "Three men and their wives buy pigs. The names of the husbands are Amos, Hiram and Jones. The wives are Sarah, Gretchen and Marie. Amos buys 23 more pigs than Sarah, Hiram buys 11 more pigs than Gretchen. Each husband pays $63.00 more for his pigs than his wife does and each pays as many dollars per pig as he or she buys pigs. Find the wife of each husband."

To solve, let one of the men buy X pigs and his wife Y. The man pays X^2 dollars and the wife Y^2 dollars. Then:

$$X^2 - Y^2 = \$63$$
$$(X + Y)(X - Y) = 63$$

We can factor 63 in three ways and find

$$A - (X_1 + Y_1)(X_1 - Y_1) = 63 \times 1$$
$$B - (X_2 + Y_2)(X_2 - Y_2) = 21 \times 3$$
$$C - (X_3 + Y_3)(X_3 - Y_3) = 9 \times 7$$

Take equation A. We have $X_1 + Y_1 = 63$ and $X_1 - Y_1 = 1$. Solve and we find

$$X_1 = 32$$
$$Y_1 = 31$$

Similarly $X_2 = 12$ $X_3 = 8$
$Y_2 = 9$ $Y_3 = 1$

Now Amos buys 23 more pigs than Sarah. But $X_1 = 23 + Y_2$. Therefore, X_1 is Amos and Y_2 is Sarah. Again Hiram buys 11 more pigs than Gretchen. But $X_2 = 11 + Y_3$. Then X_2 is Hiram and Y_3 is Gretchen. That leaves X_3 = Jones, Y_1 = Marie.

Pair $(X_1\ Y_1)$ $(X_2\ Y_2)$ $(X_3\ Y_3)$ and we have
Amos and Marie are husband and wife.
Hiram and Sarah are husband and wife.
Jones and Gretchen are husband and wife.

May I, in return, offer another problem? It is to find four right angled triangles with equal areas and their sides whole numbers.

SAMUEL GREITZER,
New York City.

(We also wish to credit T. A. Cutting, Campbell, Calif.; C. H. Rodewald, Tioga, N. Dak.; W. A. Gersdorff, McLean, Va.; Lester J. Schroll, Aledo, Ill.; André E. Levy, Mexico City, Mexico; David Schulman, New York City; L. W. Zahrn, Hobart, Indiana; Frank M. Gordon, Oakland, Maine; J. F. Norvell, Marissa, Illinois, for furnishing correct solutions to the rectangle problem or the pig problem or both.—EDITOR.)

Airscapes—the Latest in Architecture

(*Continued from page* 109)

mensions, length and breadth, but on the ground the third dimension enters. A plan of an informal garden is rarely attractive in itself, and a glade in nature with its masses of trees and shrubs, with no apparent form in outline, is extremely attractive, since shades and shadows add so much to the picture—but all of this is lost when viewed from the air.

"The higher form of garden design—namely, the formal or geometric, rather neglected in this country, must come to the fore. Plans of formal gardens are attractive on plan; there is more apparent design expressed, and such is also the case when a design is viewed from the air. For this reason European cities are so much more beautiful than our own, as seen from the air. They have more formal gardens, plazas and squares. Washington, D. C., must be our most noteworthy example of beauty."

The Value of Color

Another new factor entering into landscape architecture as viewed from the air is the visibility of color. The various hues and shades of yellow and orange are by far the most easily detected from the air. Airport boundary cones are almost invariably coated with orange-colored paint, because of the greater visibility afforded the flier. Names and markers to guide air traffic are colored similarly. Thus, masses of yellow and orange flowers, shrubs and trees must dominate in the landscape designed to delight the optic senses of air travelers. The detail is not important; it must be subservient to mass. The careful attention that many landscape architects pay to such details as texture and variety, items which the modern landscape architect junks, will be lost when seen from above.

Mr. Heminghaus believes that landscape designs are going to be more beautiful and distinct from the air than they ever can be from the ground. The reason for this is that from the air one has a chance to grasp the conception as a whole, while on the ground one can only see a portion of it.

One of the most important steps that has been taken so far in "airscaping" is in connection with Fairfax airport. "Landscaping of airports is going to prove very profitable and interesting to landscape architects," according to Mr. Herminghaus. "The airport landscape architect or designer must have a much more thorough knowledge of the principles of landscape architecture than is ordinarily needed for the development of parks or estates.

"An airport should be designed jointly by a landscape architect, an architect and an engineer. Such was the case at Fairfax, which is acknowledged by airport authorities to be one of the most beautiful ports in the world. The only available space for landscaping of airports is between buildings and streets, and usually the buildings have some approaches that are set back 100 to 200 feet from the parallel avenue. Very few trees are used, and in no case should they exceed the height of the buildings, for obvious reasons. Plenty of lawn can be used, however. My own particular conception of the design of this space is to have a big lawn and dwarf hedges such as Amor River Privets. It is noteworthy that there is almost $40,000 worth of planting material at Fairfax, with no more than ten different items."

The mayor of a California town recently refused to endorse a paving program unless the pavement be colored so as to be attractive from the air.

Clarence M. Young, assistant secretary of commerce for aviation, in a letter to each of the forty-eight state highway commissions, recently suggested that main line, hard-surfaced highways over the United States be painted with orange letters, thirty feet across, carrying the map number of the route and the state or Federal symbol for the guidance of aviators.

With air transportation rapidly becoming commonplace to the average American citizen, it is certain that we will come more and more to take into consideration the aerial view of our homes and cities. This will be especially true in laying out new additions to cities, and air transportation undoubtedly will serve to bring about greater co-operation and care in the planning and landscape gardening of residential districts, thus helping to correct a condition that city-planning engineers and landscape architects have decried in the average American city for many years.

Six-Power Binoculars

BOTH the out-of-doors man and the landscape-loving woman will appreciate these splendid binoculars, that bring far-distant objects right up close to you. The instrument is a six-power affair and weighs only four and one-quarter ounces. The focusing lever is conveniently placed where your finger can easily manipulate it. The glasses can be procured in six different colors. Each instrument is enclosed in a handsome case.

PICK YOUR JOB

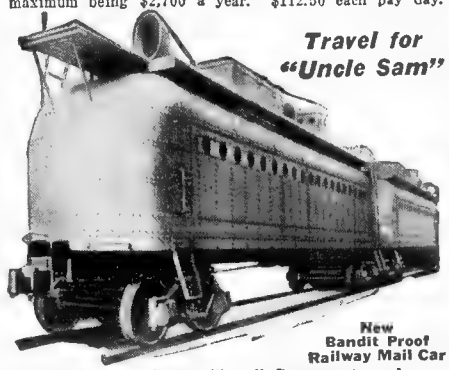
Railway Postal Clerks
City Mail Carriers
City Post Office Clerks
General Office Clerks
Customs Inspectors
Prohibition Agents
Immigrant Inspectors

NO "LAYOFFS"

These are steady positions. Strikes, poor business conditions, or politics will not affect them. Government employees get their pay for twelve full months every year.

$1,900 TO $2,700 A YEAR

Railway Postal Clerks get $1,900 the first year, being paid on the first and fifteenth of each month. $79.17 each pay day. Their pay is quickly increased, the maximum being $2,700 a year. $112.50 each pay day.



New Bandit Proof Railway Mail Car

Railway Postal Clerks, like all Government employees, have a yearly vacation of 15 working days (about 18 days). On runs, they usually work 3 days and have 3 days off duty or in the same proportion. During this off duty and vacation their pay continues just as though they were working. They travel on a pass when on business and see the country. When they grow old, they are retired with a pension.

CITY MAIL CARRIERS POST OFFICE CLERKS

Clerks and Carriers now commence at $1,700 a year and automatically increase $100 a year to $2,100 and $2,300. They also have 15 days' paid vacation. City residence is unnecessary.

GOVERNMENT CLERK—FILE CLERK
(Open to men and women 18 to 50)

Salary $1,260 to $2,500 a year. Pleasant clerical and filing work in the government departments at Washington, D. C., and throughout the country.

IS YOUR JOB STEADY?

Compare these conditions with your present or your prospective condition, perhaps changing positions frequently, no chance in sight for PERMANENT employment; frequently out of a position and the year's average salary very low. DO YOU GET $1,900 EVERY YEAR? HAVE YOU ANY ASSURANCE THAT A FEW YEARS FROM NOW YOU WILL GET $2,100 TO $2,700 A YEAR?

YOU CAN GET THEM

Experience is usually unnecessary, and political influence is not permitted. Let us show you how.

GET FREE LIST OF POSITIONS

Fill out the following coupon. Tear it off and mail it today—now, at once.

FRANKLIN INSTITUTE
Dept. C-176, Rochester, N. Y.

Rush to me entirely free of charge (1) a full description of the position checked below; (2) Free Copy of 32-page book, "How to Get a Steady U. S. Government Job"; (3) A list of the U. S. Government Jobs now obtainable; (4) Send particulars telling how I can get the position I have checked.

☐ Railway Postal Clerk.....($1,900-$2,700)
☐ Post Office Clerk.....($1,700-$2,300)
☐ City Mail Carrier.....($1,700-$2,100)
☐ Rural Mail Carrier.....($2,100-$3,400)
☐ Government Clerk—File Clerk.....($1,260-$2,500)
☐ Inspector of Customs.....($2,100-up)
☐ Prohibition Agent.....($2,300-$2,800)

Name .....

Address .....

Use This Coupon Before You Mislay It.

Fun with a Violet Ray Machine

(*Continued from page* 139)

audience by inviting one of the crowd to fight a duel with you as shown in Fig. 3. If you wish, the high frequency current can be taken through your body. The spark will jump from the metal rod held in your hand to your opponent's foil. With a more powerful apparatus than the small hand type, the effect is more startling both to the audience and the would-be duelist.

You will be surprised, no doubt, by the results obtained even with the one-inch spark apparatus. The average person is surely not accustomed to having sparks play about his body and the writer has seen many otherwise phlegmatic men become frightened when introduced to electrical spark phenomena that threaten to get on such close relations as jumping to their skin or even to a sword held in their hands.

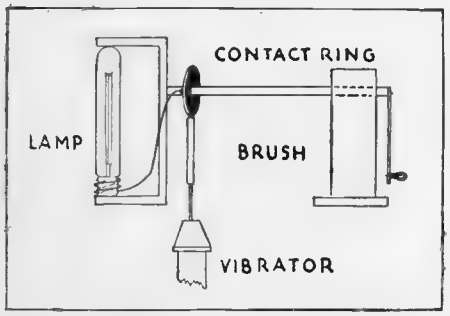


Fig. 8—An easily made hand rotator, to be used as explained in the text.

A very pretty experiment is that illustrated in Fig. 4 which calls for the use of two wire circles. The smaller ring is placed either within the larger one or to one side of it. One ring is connected to the vibrator and the other is grounded. When so arranged a cone of sparks is produced between the two. Those having the use of one of the larger violet ray machines will obtain a more spectacular effect as the rings can be separated farther.

Using either incandescent lamps, even those with broken filaments will do, or the glass vacuum electrodes supplied with violet ray apparatus, many beautiful and entertaining exhibitions may be successfully completed. With the smallest violet ray machines, one of the first experiments you can make is that illustrated in Figure 5. As can be seen, the showman holds the electrode of the high frequency machine close to a nail which protrudes from his mouth. In one hand he holds a lamp by the round end. A second person grasps another lamp similarly so that the metal bases of the two bulbs make contact. This individual also holds a wire which is connected to the ground. The high voltage discharge passing through the two bodies will cause the lamps, through which it also flows, to glow with a most weird, bluish-white light.

Three ways in which to light an ordinary incandescant lamp are shown in Figure 7. The topmost lamp is illuminated by allowing the spark to jump from the charged wire electrode to the metal base of the bulb. The lamp in the center is held in the hand and the spark jumps to the metal base. A stronger illumination is obtained from the bottom bulb by holding the metal base firmly against the electrode.

For a novel and brilliant experiment you can hold either a lamp or vacuum electrode in your hand and approach it to the surface of a glass of water (see Figure 6). The liquid may be colored by dyes or other means. A pretty effect is obtained when the glowing lamp or tube is immersed in the water. The ground connection may be made to the water itself, but placing the glass on a grounded metal plate works very well indeed.

Some unusual effects can be worked out by arranging one or more lamps or vacuum electrodes on a revolving disc. A fan motor which is probably gathering dust in your attic just now may be put to very useful service for this experiment. You will be agreeably surprised at the many varied patterns that will be produced by changing the frequency of the current in the Oudin coil. This is done by adjusting the vibrator screw. You can also vary the speed of the motor. For best results variable resistance should be connected in series with the motor. A hand rotator which you can very easily make yourself can be used as illustrated in Fig. 8.

Most startling and impressive is the situation that you can produce by showing your friends that you have electric hands. Suppose that when persons attempted to shake hands with you, a spark jumped unexpectedly to their fingertips giving them a mild shock! You can stage this as a little surprise for some of your good friends. The high frequency apparatus can be placed in a closet or in another room if necessary so that no noise will be heard to arouse suspicion. Then by connecting the coil to a piece of wire netting or fly screen placed under the rug upon which you are to stand, you are about ready for this performance.

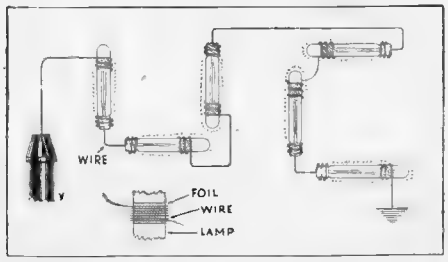


Fig. 9—How to connect several lamps for high frequency experiments.

A phoney "electric chair" always provides a lot of excitement and plenty of fun. The apparatus can be used for platform lectures and also, "shush"! What a royal "goat" this will make for fraternity initiations. Having actually been stung by one of these "electric chairs," the writer has sworn off joining any more benevolent organizations, unless he can personally inspect the initiation room. Even then he may be sadly fooled for the chief of the degree team may bring the violet ray apparatus along in his pocket.

Surprising as it may seem the smallest violet ray machine will produce a world of fun for parties, bazaars and other entertainments if a wire from the apparatus is joined to a piece of wire screen placed under a thin cloth cover in the seat of a chair. You will get many a good laugh watching the expressions, indignant and otherwise, on the faces of those who accept the challenge to sit in the chair. Not many will remain seated long, for the first spark usually is the stimulus for a wild yell and a meek admission that the device is too much for the daredevil. The larger high frequency coils, yielding a two to four inch spark will of course give much more spectacular and interesting results. A word of caution at this point—do not place your hand or any other part of your body in contact with grounded metal such as a radiator or sink and then extend your hand towards the charged wire of the high frequency apparatus. This usually gives an unpleasant shock.

Illuminated letters—quite large in size—which will serve nicely to introduce your act, may be made by connecting a number of vacuum electrodes or incandescant lamps, preferably those of the straight tubular type in series as diagrammed in Figure 9. Where it is necessary to make a connection to the free end of the lamp, a piece of tin or copper foil may be wrapped around the glass and bare wire fastened around it.

Fig. 7—Three ways of causing bulbs to glow through the use of high frequency currents.

Taking 40,500 Photographs Per Second

(*Continued from page* 112)

may be accomplished by means of a revolving shutter before the eye, the speed of which is so adjusted as to make the moving part being viewed seem to stand still. It may also be accomplished, as in the stroboglow, by illuminating the object by successive flashes of light timed to make the object appear stationary. The stroboscopic method is a very useful one for studying the behavior of high speed machine in which the motion is repeated over and over again. It will be evident that it does not apply to an event which occurs but once—the breaking of a lamp bulb, for example, which would never occur twice in exactly the same manner. The high speed camera gives us our only opportunity to scrutinize what happens in such cases. In the stroboscope no permanent record is made. It would have little more meaning than a photo of the object standing still.

Outside of the study that has already been made of airplane propellers and wings, consistent with the duties of Baron Shiba at the Aeronautical Research Institute of Japan, the photographs taken have been of minor consequence and intended only to show the possibilities of the method. When the procedure of taking these pictures has been further simplified and standardized it is quite likely that photography of this sort will play a useful part in industry. The manufacture of parts, which have been found to fail, will be carefully scrutinized by this method to find exactly what it was in the stamping or bending which weakened the part produced. Machines will be examined to determine the source of vibration. Other problems will occur to anyone familiar with high speed production.

It is rumored that Baron Shiba is working toward an even higher speed than he has already produced, and that a speed of 60,000 pictures a second may be expected in the near future. With such speeds one might expect to observe a lightning flash jumping between two clouds with all the speed which one associates with the rate of travel of a fish worm. What an odd world this would be if all motion were, in actual fact, slowed down to this absurd rate!

The Unseen Menace of the Mississippi Flood Control

(*Continued from page* 119)

related to the silt deposited by the annual overflow of the great stream. The same thing is true of the alluvial valley of the Mississippi. It is certain that years of flood protection will progressively reduce the fertility of the soil, and the wealth, of course, which that fertility has brought forth.

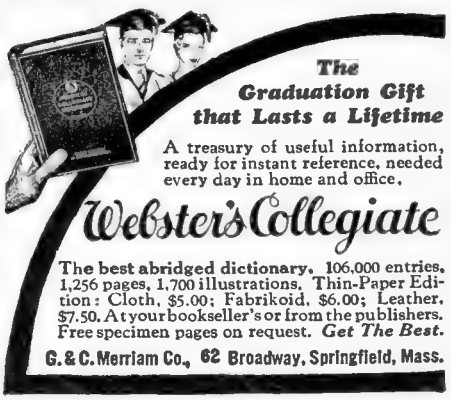
The soil of the alluvial valley produces a long staple cotton that is definitely superior to the cotton grown on higher lands; and it produces more of it per acre. It was this fertility which stimulated the growth of the river's towns and trade. The towns and trade have been the chief reasons for the development of flood protection. Now, if perfect protection shuts off, for a long period, the deposits of silt which have previously renewed the fertility of the alluvial soil, towns and trade will suffer from the lowered production of wealth, and the valley will begin to retrograde toward poverty.

Imperfect protection permitted catastrophes—but it also permitted the river to leave a new deposit of silt on the alluvial soil. Perfect protection may reduce fertility to a point where many floods will be needed to restore it. Already this phenomenon is taking place in some parts of the Mississippi system. In the upper Yazoo Basin, protection has been perfect for the past forty or fifty years, and a definite reduction in soil fertility has been observed in consequence. Apparently, when dealing with the Father of Waters, you're damned if you do and you're damned if you don't! There actually seems no way to beat him!

However, protection for the people of the lower valley is the problem of this generation, so the War Department is going ahead full steam. If the next generation needs silt to revive its land, it can take a turn at the problem of non-protection. Today's job is control.

Concrete revetment. The slabs were placed on the bank by a derrick boat.

Logically, the most elaborate work in flood control will be executed in that part of the Mississippi adjacent to the Gulf, where the accumulated torrent of the river and its great tributaries rushes headlong into the sea. New Orleans will be protected from high currents and great flood volumes by a spillway at Bonnet Carré, on the east bank, just above the city. (See (1) on map.) Here, in high flood, 250,000 second-feet of water will be diverted to Lake Ponchartrain. New Orleans levees, already wide of crown and base cross-sections, will be further widened, flattening the slopes against the river's attack. A hundred miles farther up the



The Graduation Gift that Lasts a Lifetime

A treasury of useful information, ready for instant reference, needed every day in home and office.

Webster's Collegiate

The best abridged dictionary. 106,000 entries, 1,256 pages, 1,700 illustrations. Thin-Paper Edition: Cloth, $5.00; Fabrikoid, $6.00; Leather, $7.50. At your bookseller's or from the publishers. Free specimen pages on request. ***Get The Best.***

G. & C. Merriam Co., 62 Broadway, Springfield, Mass.

"Mary, I Owe It All to You"

"Mr. Williams called me into his office today and told me he was going to raise my salary $50 a month.

" 'I am glad to give you this opportunity,' he said, 'for the best reason in the world. You deserve it.

" 'You may not know it, but I've been watching your work since the International Correspondence Schools wrote me that you had enrolled for a course of home study. Keep it up, young man, and you'll go far. I wish we had more men like you.'

"And to think, Mary, I owe it all to you! I might still be drudging along in the same old job at the same old salary if you hadn't urged me to send in that I. C. S. coupon!"

How about you? Are you always going to work for a small salary? Are you going to waste your natural ability all your life? Or are you going to get ahead in a big way? It all depends on what you do with your spare time.

More than 180,000 men are getting ready for promotion right now in the I. C. S. way. Let us tell you what we are doing for them and what we can do for you.

Mail the Coupon Today

INTERNATIONAL CORRESPONDENCE SCHOOLS
"The Universal University"
Box 6164-G, Scranton, Penna.

Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the subject *before* which I have marked X:

TECHNICAL AND INDUSTRIAL COURSES

☐ Architect
☐ Architectural Draftsman
☐ Building Estimating
☐ Wood Millworking
☐ Concrete Builder
☐ Contractor and Builder
☐ Structural Draftsman
☐ Structural Engineer
☐ Electrical Engineer
☐ Electric Wiring
☐ Electric Lighting
☐ Welding, Electric and Gas
☐ Telegraph Engineer
☐ Telephone Work
☐ Mechanical Engineer
☐ Mechanical Draftsman
☐ Patternmaker ☐ Machinist
☐ Reading Shop Blueprints
☐ Civil Engineer
☐ Highway Engineering
☐ Surveying and Mapping
☐ Gas Engines ☐ Toolmaker
☐ Diesel Engines
☐ Aviation Engines
☐ Bridge Engineer
☐ Automobile Work
☐ Plumbing ☐ Steam Fitting
☐ Heating ☐ Ventilation
☐ Sanitary Engineer
☐ Sheet Metal Worker
☐ Steam Engineer
☐ Marine Engineer
☐ Refrigeration
☐ R. R. Locomotives
☐ Air Brakes
☐ Train Operation
☐ R. R. Section Foreman
☐ R. R. Bridge and Building Foreman
☐ Chemistry ☐ Pharmacy
☐ Coal Mining Engineer
☐ Navigation
☐ Agriculture
☐ Textile Overseer or Supt.
☐ Cotton Manufacturing
☐ Woolen Manufacturing
☐ Fruit Growing ☐ Radio
☐ Poultry Farming

BUSINESS TRAINING COURSES

☐ Business Management
☐ Industrial Management
☐ Personnel Management
☐ Traffic Management
☐ Accountancy
☐ Cost Accountant
☐ C. P. Accountant
☐ Bookkeeping
☐ Secretarial Work
☐ Spanish ☐ French
☐ Salesmanship
☐ Advertising
☐ Business Correspondence
☐ Lettering Show Cards
☐ Stenography and Typing
☐ Complete Commercial
☐ English ☐ Signs
☐ Civil Service
☐ Railway Mail Clerk
☐ Mail Carrier
☐ Grade School Subjects
☐ High School Subjects
☐ Illustrating ☐ Cartooning
☐ Lumber Dealer

Name.....Age.....
Street Address.....
City.....State.....
Occupation.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

valley, on the west bank, the Atchafalaya River valley will be utilized to divert a further portion of the waters directly to the Gulf. (See (2) on map.) All through this considerable territory, levees will be strengthened, and in some cases made higher.

Between Old River (north end of the Gulf section) and the mouth of the Arkansas, levees will be raised on both sides of the Mississippi. To relieve extraordinary pressure on these levees, a great natural canal, known as the Boeuf Basin floodway, will divert excess water near the mouth of the Arkansas. (See (3) on map.) The water thus diverted will finally make its way back to the main stream through the Red River basin, which the Boeuf River joins. (See (4) on map.) Auxiliary levees will help to control the diversion, which will affect land largely occupied by swamps. Protection for land in the floodway will be maintained at present standard. Overflow probably will occur only once in twelve years. There will be a definite gain in protection for a great populated territory.

From the Arkansas to Cape Girardeau, Missouri, levees will be strengthened and raised: (See (5) on map) and on the west bank, opposite Cairo, the levees will be set back five miles, relieving, by allowing lateral spread, the pressure of flood waters on the levees of the city. (See (6) on map.) In this section no floodway is thought necessary because of the un-leveed areas available for flood travel on the east bank.

The average Mississippi levee being built or formed by enlargement of old levees today has a crown of ten feet, a height of twenty to thirty feet, and a width at the base of from two hundred to three hundred feet. Levees are constructed by scraping up and dumping into place millions of yards of alluvial earth from the bed of the valley. Sometimes they are built up by scraping alone, at other times by a combination of scraping and hauling with tractors and trailers. Once mules and scrapers formed the main dependence of levee builders, and the banks built by these means were superior in quality to the power-built levees of today because of the packing action of the mules' feet. But the levees of today overcome the drop in quality by their increased size.

Several types of levee-building outfits are in use on the Mississippi, the variation being due mainly to the fact that the work is done mostly on contract, leading contractors competing against each other in developing machines whose functions will enable the job to be done swiftly and efficiently, with as little dual handling of material as possible.

The porous nature of levees lets water percolate through at the foundations and come up on the land side. If, as sometimes happens in flood time, the water getting through moves rapidly enough to carry material with it, a cavity will soon be gouged out, undermining the structure; and the levee will cave and turn the water loose over the land. Wide bases, with muck ditches to cut seepage lines, are used to combat this attack. If the attack becomes acute, it shows itself by a bubbling up of sandy water behind the levee. This stage, known as a "sand boil," is treated by constructing sandbag wells. Circular walls of sand bags are placed around the boil, and the hydraulic head thus created forms a counter-pressure against the water trying to break through. During a major high water, vulnerable levees are patrolled at all times, and the ground behind them is soon spotted with sandbag wells.

When seepage through the levee itself becomes heavy, slides of earth occur from its face, particularly if the cross-section is relatively shallow and the slopes rather abrupt. A ballast armor of sandbags is one of the means used to prevent slides during high water. If sliding has already occurred, an emergency loop of sand bags and earth, supported by timbers, may be utilized as a second line of defense at the spot. Wide sections, sodding, and careful maintenance are the three things having most to do with a successful levee system.

The Father of Waters is a random and meandering stream, continually—particularly at flood times, but even at other times—changing the conformation of his banks, caving them in at one place and building them up at another. Usually the progress of caving is countered by moving back a part of the levee system, but at some points it is worthwhile to stabilize the bank against further erosion. This is done by revetting. Great mats, in traditional revetting, are woven of young willows and cottonwoods, and are sunk below the low water line of the river, weighted down with stone. Above the low water line the bank is paved with concrete or stone to protect it in flood. In this way both scouring and sliding are effectually prevented. Mats are far more expensive than levees, but remain effective safeguards for eighty years or so.

The average mat is in size about 300 by 1,000 feet, and is woven of young trees having a diameter of one to three inches. These are bound together in fascines or bundles of ten to sixteen inches diameter, which in turn are bound side by side with wire cable and poles to form the mat. The regular method is to weave the mats on barges placed at right angles to the bank, and to slide them into the water as they are completed. The job finished, barges carrying stone are brought up, and the stone thrown upon the mat to sink it securely in place. The mat, being flexible, conforms closely to the contour of the river bed. Then the bank is graded and guarded with paving on a gravel base.

When willow trees become scarce, at certain points, a flexible concrete mat was developed for revetting purposes. One form of this mat is composed of reinforced slabs, one foot by four feet, lying crosswise upon parallel jointed wires. It is prepared on barges especially designed for its manufacture and placing, and as it is completed it is laid from the bank toward midstream, sinking of its own weight. The other form of concrete mat, made and placed in the same way consists of slabs, five feet by eleven feet, overlapping each other in shingle style on wires.

Underwater scouring being by far the most important factor in bank caving, the mats form an exceedingly efficient protection. The city of Memphis has been protected extensively by mat revetment, after caving of its foundations had cost many structures and improvements. Mat revetment also protects the harbor of New Orleans, where levee lines, docks, and other improvements at the very bank of the river make protection against scouring very important.

Already the results of the government's control work are observable in the lower valley. It is not generally known, or noted, that in the Spring of 1929 one of the highest waters recorded passed down the valley without causing a single crevasse in the levee system.

Revetments are also made by paving the surfaces of prepared slopes with concrete.

Method of treating sand boils.

Movie "Machine Gun" Checks Aerial Marksmanship

(*Continued from page* 120)

a flying machine. When put to the latter use we can obtain a practical insight into the fighting suitability of the different types of planes, their speed, power of turning and climbing, especially when two planes simultaneously (photographically) shoot at one another.

The gun can carry about 120 feet of film, corresponding to about 1,000 pictures. In order to be able to time the snapshots and also test the skill of the operator, two lenses are fitted, one projecting upon the film the object under observation, while the other projects the dial of a chronometer, divided into hours, minutes and 1/10 seconds. The photographic gun consists of four main parts, the lock, the casing, the mechanism and the lenses.

The lock contains a strong spring which can be wound up by means of a detachable crank and which ensures a regular motion of the film. An automatic counter fitted behind the lock shows the amount of film used, while a special lever is added for safety. The aluminum casing has a light-proof shutter. Other attachments are the axes for the spools for the unexposed and exposed film.

The mechanical part of the camera is built on orthodox lines, except that provision is made for photographing at the rate of either eight pictures per second or four pictures per second, according to whether it is desired to photograph both the object (the "enemy" plane) and a chronometer dial so that the time of each exposure may be recorded, or only the plane without any time record.

To meet these conditions, two optical systems are fitted, the lens used to photograph the object having a focal length of 210 mm. and an aperture of f.5.7. The lens for photographing the chronometer dial has a focal length of 42 mm., and an aperture of f.4.5.

Let us for a moment consider the above described invention from a pacifist point of view! Let us look ahead at future development and assume the ideas of a well-known European pacifist, Prof. Barr. The latter once put before a pacifist meeting the proposal that nations should settle their differences by means of a kind of chess game. The opponents would take up position on a miniature seat of war, agreed to beforehand, complete with counterfeit instruments of war, which would have all the appearance of their more serious originals. In this way the victory would fall to that side which had the most perfect technical command over those instruments.

Could this cinematograph machine gun have been in the mind of this European dreamer? Would it not be an ideal alternative to the death-dealing machine guns, and a wonderful instrument for the determination of the superiority in the air between nations?

Play Piano Accordion

for dances and parties

NO wonder Piano Accordion players are so popular in orchestras, on the radio, at parties. They give their listeners something *different* in music—they are a whole orchestra in themselves.

Surprise yourself. Astound your friends. Learn to play this captivating instrument or any other instrument right at home in a few short months—even if you don't know one note from another now.

PICK YOUR INSTRUMENT

Piano	Violin
Organ	Clarinet
Ukulele	Flute
Cornet	Harp
Trombone	'Cello
Mandolin	Piccolo
Saxophone	Guitar

Banjo
Voice and Speech Culture
Drums and Traps
Piano Accordion
or any other instrument

Nothing could be easier. No grinding practice. No trick music. You always play from actual notes. Little theory. Plenty of accomplishment. Best of all, no matter which instrument you select, the cost of learning averages no more than a few cents a day. Mail coupon now for Free Book describing our print and picture method. Also ask for Free Demonstration Lesson. Instruments supplied when needed, cash or credit. U. S. School of Music, 306 Brunswick Bldg., New York City.

U. S. SCHOOL OF MUSIC,
306 Brunswick Bldg., New York City

Please send me your free book, "Music Lessons in Your Own Home," with introduction by Dr. Frank Crane, Free Demonstration Lesson, and particulars of your easy payment plan. I am interested in the following course:

Have you
.....Instrument?.....

Name .....

Address .....

City ..... State .....

NERVE TORTURE

End it, or it will end YOU

Nearly all **common disorders**—indigestion, constipation, auto-intoxication, weak heart, weak sex and general nervousness—are due to **WEAK NERVES,** also mental depression, sleeplessness, fears, lack of self-confidence, etc.

If YOU are Nervous or have Weak Nerves—*read* a reprint of some important lectures I have given on the subject. I can help **YOU** and I have helped over 150,000 others during the past 30 years. My 64-page book on **Nerve Culture** is also offered **FREE**—no obligations. Send 10 cts. to cover postage and mailing.

Paul von Boeckmann (*Nerve Culturist and Psychologist*)
1447 Cellini Bldg., 48 West 48th Street, New York

EXPO WATCH CAMERA

SEND ONLY $1

NO BIGGER THAN A WATCH

Makes marvelous, sharp pictures ⅝" x ⅞", that can be enlarged up to 3¼" x 4¼". No focusing. Press the button and the picture is yours. "Time" and "Instantaneous" shutter. Loads in daylight. 20 exposure film costs only 30 cents. Send $1 for Camera and film. Pay postman $4 plus postage. Money back guarantee. Send today. Big catalog of Photo and Optical goods free.

CENTRAL CAMERA CO., 230 S. Wabash Ave., Dept. 36, CHICAGO

EASY TO MAKE MONEY

in your spare time by building these miniature models of Ship, Coach or Spinning Wheel.

We supply all parts, easy to put together, with full instructions and diagrams.

Ready market and steady demand from gift shops and other sources at a good profit. Send for **FREE Catalog.**

MINIATURE SHIP MODELS, INC.
Dept. SI **Perkasie, Pa.**
Canadian Offices 90 King St., W. Toronto

200% to 600% PROFIT

24 Karat Gold Plated

Every man buys. Biggest money-maker in years. Big opportunity to earn **$50 to $100 a Week**

The Crest Collar Layrite

Invisible device keeps soft collars flat and free of wrinkles. On in a jiffy. Eliminates starching. Lasts forever. Men buy several at one time. Sells for only 25 cents. Don't complain of hard times. Here's sure-fire money-maker. No competition. Send 25 cents for sample and complete details.

CREST SPECIALTY CO.
29 Crest Bldg., 227 W. Van Buren St., Chicago, Ill.

How To Secure A Government Position

Why worry about strikes, layoffs, hard-times? Get a Government job! Increased salaries, steady work, travel, good pay. I'll help you become a Custom House Clerk, Railway Postal Clerk, Post Office Clerk, City Mail Carrier, Rural Carrier—or get into any other Government job you want. I was a Secretary Examiner of Civil Service Commission for 8 years. Have helped thousands. Open to citizens 18 to 50. Get ready NOW for the *NEXT Railway Postal Clerk Examination!*

Now FREE My 32-page book tells about the jobs open—and how I can help you get one. Send the coupon for your copy TODAY.

A. R. PATTERSON, Civil Service Expert,
PATTERSON SCHOOL, 906 Wisner Bldg., Rochester, N. Y.

Please send me, without obligation, your free book, "How to Secure a Government Position."

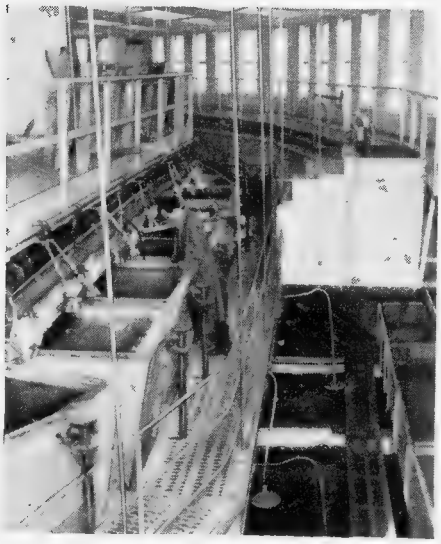
Name.....

Address.....

Behind the Scenes in a World Renowned Aquarium

(*Continued from page 123*)

we started from. We follow the guide down some more stairs and find ourselves in the complicated, though neat, engine room. We meet the chief engineer, who gladly explains what all the pumps do. He tells us that three kinds of water are used in the Aquarium—ocean water, bay water and fresh water. The ocean water is brought in by tank ships and transferred to the Aquarium's 110,000-gallon tank located under Battery Park.



The tanks as seen from behind.

Through a closed circulation system this water is used over and over again, and the most remarkable thing about this is the fact that, although 300,000 gallons of water are pumped through the tanks each day, this ocean water does not have to be renewed or replenished for at least one year. The bay water is so polluted that it cannot be used, but an artesian well, located right under the Aquarium, supplies this type of water *minus* the pollution. Fresh water is taken direct from the city water supply and, in some cases, is brought from lakes and rivers. The pumps keep the water in constant circulation and a duplicate set of pumps is always ready to be switched on during an emergency. Two compressed air pumps are available for use should such an extreme emergency as the total shutting off of the water supply occur. Everywhere we see a maze of pipes and it is said that the Aquarium has more piping than any other building of its size in the world. The chief engineer explains that most of the pipe is of special manufacture—the fresh water pipes being lined with vulcanized rubber to prevent corrosion.

As we leave the pumping room we pass through the boiler room and find the fireman very busily engaged in feeding coal to the fires. He tells us that these boilers are used to maintain the correct water temperatures in the various tanks, some fish requiring warmer water than others. Leaving the boiler room we are conducted to the giant filters. These are long pipes with numerous perforations out of which pour many streams of water. As the water gathers in the pit under the pipes it seeps through several layers of sand, rock, earth, etc., and after passing through these filters, it becomes pure again.

Our guide tells us we are now to see one of the most interesting parts of the whole Aquarium, namely, the large research laboratory. We ascend three flights of stairs and, as we enter a long room, a brilliant bluish light attracts our immediate attention. Closer observation proves it to be a mercury vapor sun-ray lamp placed over a tank of small fish. These fish are ill and a laboratory worker is giving them artificial sun-light treatment. The room is full of small sized aquariums, pipes, microscopes, retorts, and other scientific instruments. Several laboratory workers are engaged in research work, caring for fish that are ill, studying the habits of new specimens, etc. While the Aquarium has complete equipment for the care of sick fish it is more interested in preventive measures and prolonging the lives of the specimens. Our guide tells us that there are over 100,000 known specimens of fish and adds that the study offers an inexhaustible field, and that the more they learn about fish the bigger the field seems to become.

Extensive research work is carried on in the aquarium laboratory.

Do fish live as long in captivity as they do in their natural environment? We were unanimous in the thought that, despite the great care they receive at the Aquarium, they could not possibly live as long there as outside of it. The answer was that they do live longer in the Aquarium for the following reasons: In the depths of the ocean or river a constant struggle is going on—a struggle of the survival of the fittest. Fish fight and devour other fish! Many times there are conditions that approach what we call a famine and the fish die of hunger. In the Aquarium such conditions do not exist. Natural enemies are kept apart, as are those that prey upon other fish. They live in ideal water conditions, they know that they will be fed regularly, and they are really contented and happy, with the result that they live a long time. The average life of a fish is from two to four years and, we are told, some specimens live for twenty-five years.

Leaving the laboratory we pass out into the hall, at the far end of which we can see the Aquarium director's office. The door is open and we notice a little wired enclosure right in front of the director's desk. A little penguin is in the enclosure and we ask the guide if we might look at it. But just then the director, Charles Haskin Townsend, comes to the doorway and invites us all in. We gather around the cute little penguin and the director starts to explain why he is keeping it in his office.

It seems that up to a recent date the Aquarium boasted of two Galapagos penguins who couldn't adjust themselves to their new home. One of them died and the other one became lonesome and ill at the loss of his pal. Although he was tempted with the choicest food and greatly petted, he continued to brood. The director finally ordered that he be placed in the wired enclosure in his office, but there was no noticeable change in the penguin until a small full length mirror was put in the cage. The penguin now spends most of his time in front of the mirror and believes that his own reflection is really another penguin and he is now improving.

We all feel sorry for the little fellow as we start down the stairs again to the main rotunda. At this point we find a tank of salmon beside which are a series of glass stairs or steps with a stream of water running down them. Some of us remembered having seen the salmon swimming up against the strong current of the Columbia River and had watched them leap up small waterfalls, to spawn and die. That is why these little glass steps are placed beside the tank of salmon. Soon they will be leaping up those steps just as their brothers do in the Columbia River.

The guide tells us that as far as possible the Aquarium tries to reproduce the natural living conditions of the various specimens.

We consult our watches and find that we have spent the greater part of the entire day for our interesting and enlightening visit. We thank our guide, who leaves us and goes back to his beloved laboratory — while we depart through the huge original doors of the historic old building, feeling for a moment as though we had been in a land of dreams and are now waking up.

The Romance of Glass

How often have you contemplated the various articles around the house which are made of glass, and wondered how such things are made? In the July issue of SCIENCE AND INVENTION there will appear an exceptionally fascinating article in which our readers will be taken on a tour through Corning Glass Works at Corning, N. Y.

Some Curious War Inventions

(*Continued from page* 116)

warfare. As a means of defense in repelling surprises and skirmishing attacks on those engaged in a peaceful avocation it is unrivalled, as it can be immediately brought into action by disengaging the team, and in times of danger may be used in the field, ready charged with its deadly missiles of ball or grape. The share serves to anchor it firmly in the ground and enables it to resist the recoil, while the hand levers furnish convenient means of giving it the proper direction."

The two inventors, who were inhabitants of Waterloo, N. Y., were probably inspired by the story of Cincinnatus, the Roman dictator, who was recalled from the plow to take up arms against a foreign invader.

The second patent is that granted to Macdonald, No. 611,593, during the Spanish-American War for means for closing shot holes in warships. The invention is best described in the language of the patentee: "In making use of my invention the space between the inner casing and the outer plates is first filled as far as practicable with hemp fiber, unspun or loose, a number of loose balls are laid regularly therein, and then tar, heated to a freely fluid condition, is poured into the space. The tar will fill up the remainder of the space not occupied by the hemp and balls. If now the outside of the vessel is pierced by a shot, the hemp and tar will immediately begin to flow into the aperture so made along with the water and will fill the same before a considerable quantity of water has passed therethrough."

Among the many curious inventions inspired by the Great War are the following:

Patent 1,143,233 to Schramm, dated June 15, 1915. for a device for capturing submarines. With this object in view, a ship is provided with electromagnets strong enough to draw submarines and other metallic objects out of their course and toward the ship. When the submarine is attracted to the side of the ship, an electric circuit will be closed and a signal bell and lamp actuated to notify the crew of the ship of the capture. And the optimistic inventor goes on to say "The submarines will also be electrified, shocking the crew thereof and killing or rendering them temporarily helpless." The patentee, however, neglects to inform us whether the device is intelligent enough to distinguish between German submarines and those belonging to the allies.

Patent 1,187,218, dated June 13, 1916 was granted to Wister for an attachment to make a gun or cannon shoot around corners. The attachment consists of a curved section of wider bore than the gun which can be screwed on to the end of the gun. A periscope may be attached to the muzzle of the gun so that the marksman need not expose himself to the fire of the enemy.

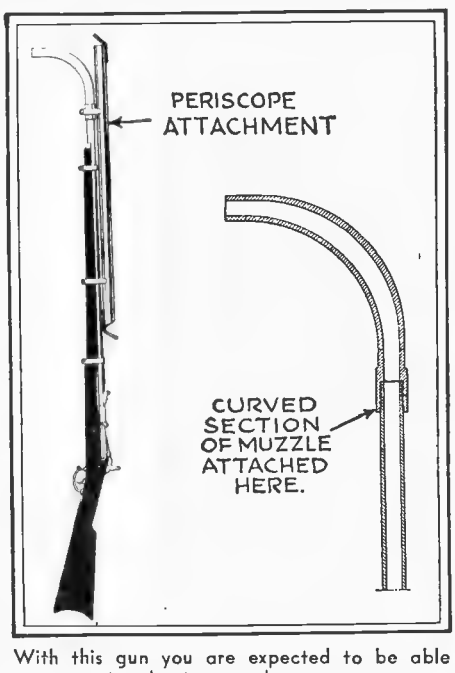
Patent 1,183,492, dated May 16, 1916 to Pratt for a helmet equipped with a gun which can be aimed by movement of the head and fired by pneumatic means operated from the soldier's mouth. This leaves his hands free so that he can use his bayonet or sword.

Patent 1,284,155 to Shartzer dated November 5, 1918 for an electric gun or rifle, operable to set off a distant mine or container of high explosive. The rifle is provided with mechanism for producing a high tension current (Hertzian waves) which can be concentrated by means of a lens secured on the end of the rifle into a powerful ray. The mine must, of course, be provided with a receiver for Hertzian waves so as to be actuated by the ray sent from the gun. The lens is said to be also suitable as a magnifying glass to help in aiming the rifle.

Patent 1,310,533 to Karton, dated July 22, 1919, for means for screening a ship. The patentee suggests encasing the entire ship with huge mirrors extending from the water line to the highest mast. The mirrors will reflect the surface of the ocean and effectively hide the ship.

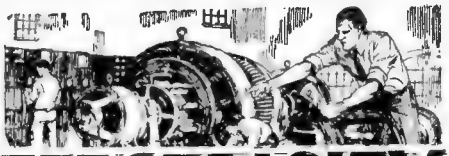
Patent 1,532,859 to Balch dated April 7, 1925 for a device which will fire automatically upon its wearer's raising an arm in response to the command. "Hands up!" The device is adapted to be strapped about the waist and to be connected to both arms of the user. To quote the patentee, "If the user is approached by a hold-up man from the rear and is ordered to throw up his hands, the left hand is raised higher than the right to actuate the rear device. If approached from the front, the right hand is raised higher to actuate the front device."

Obviously, no one but a cool, calm and collected person is capable of safely using this device. For, in a forgetful moment, even the most careful user is likely to set off the device by merely scratching his head. Such a contingency evidently did not bother the inventor.



With this gun you are expected to be able to shoot around corners.

MEN WANTED
Under 35 Years Old
for well paid positions in



ELECTRICITY

ELECTRICAL
Engineering
Drafting
Power
Telephone
Radio
Telegraphy
Railways

First Lesson FREE
See How Easy to Learn

This "machine age" means unemployment and low wages for millions of men—but it also means more jobs and higher wages for those who go into ELECTRICITY. Automatic machinery means Electrical power and Electrical control. Electricity is expanding so rapidly—that here is one chance for the man out of a job, or worried about losing it. You can learn—in your spare time—and we will send you a lesson free to prove it.

Electricity . . . . . .
Always Growing—Always Prosperous

No wonder—because Electricity is the basic *power* of all other industries. It is Telephone, Telegraph and Radio. It is light and heat and so many more things, we'll have to send you a book to list the opportunities it offers you. No panic can stop it. And if you want a chance to make a good salary, and be secure for the rest of your life, INVESTIGATE Electricity.

Remarkable Offer—right now

If you act quick, we'll show you how to get a well-paid Electrical position at a big saving. This offer limited to men with at least a grammar school education, and under 35 years of age. Mail coupon now.

American School
Dept. EA-74
Drexel Ave. and 58th Street Chicago, Ill.

AMERICAN SCHOOL,
Dept. EA-74, Drexel Ave. and 58th St., Chicago, Ill.
Please tell me, without cost or obligation, about your training and employment service in line marked X below.

☐ ELECTRICITY
☐ Architecture
☐ Building
☐ Drafting
☐ Business Management
☐ Accounting
☐ Mechanical Engineering
☐ High School in 2 Years
☐ Structural Steel
☐ Civil Engineering
☐ Auto Engineering

Name ----------
St. No. ----------
City ---------- State ----------
Age ---------- Occupation ----------

AVIATION Information FREE

Send us your name and address for full information regarding the Aviation and Airplane business. Find out about the many great opportunities now open and how we prepare you at home, during spare time, to qualify. Our new book "Opportunities in the Airplane Industry" also sent free if you answer at once.

AMERICAN SCHOOL OF AVIATION
Dept. 142-A, 3601 Michigan Ave. CHICAGO

BUILD YOUR OWN
AUTOMATIC ELECTRIC REFRIGERATOR

Why pay $200.00 and upwards? You can use your present ice-box-Can be done easily in the home workshop-Costs you only $34.50 for parts to complete-Operating cost and results compare favorably with well-known makes- Blue-prints with thorough instructions $1.00. We also supply special parts.

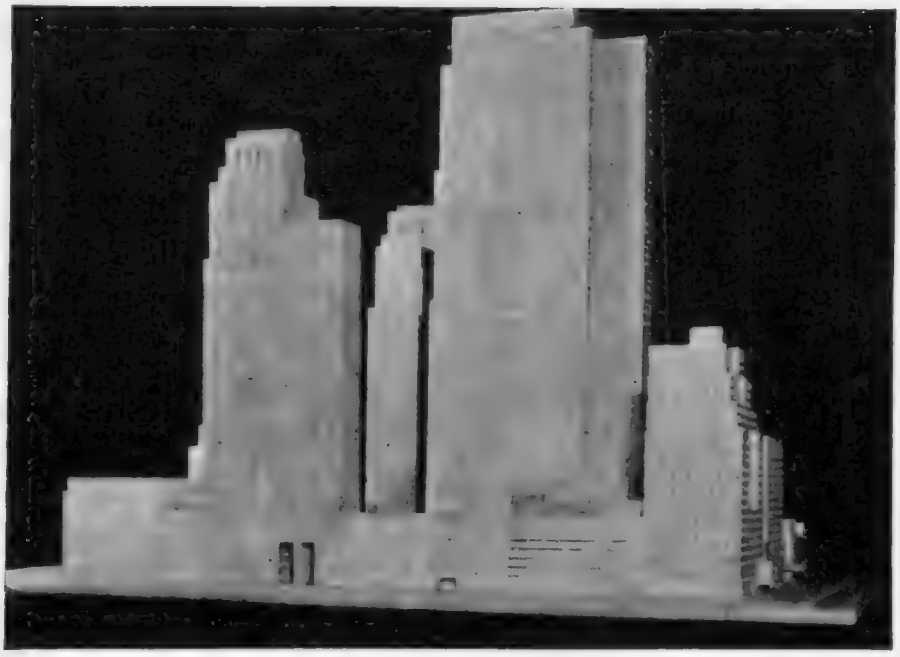
B & L ENGINEERING Co. 62 Greenville Av. Jersey City, NJ

World's Super Amusement Center—Radio City

(*Continued from page 127*)

plans, will be occupied by a bank, while the upper floors will be occupied by shops and showrooms. In this connection, it should perhaps be pointed out that the site is located in the heart of the fashionable mid-town shopping area of New York.

In the middle of the 48th Street side a site 350 feet long by one block wide has been reserved for the Metropolitan Opera House. This space is amply sufficient for all the requirements, including scenery storage space, of a full-sized opera house. Negotiations between the sponsors of the project and the Metropolitan Opera Company have been going on for some time, but at the time of writing no agreement has been reached, so it is uncertain whether the opera company will avail themselves of the site. John R. Todd, President of the Todd, Robertson, Todd Engineering Corporation, which has charge of the construction, said in a statement: "We would love to have them come in, and we think it will be to the best interests of everybody if they do come in."



Radio City as seen from the northern approach.

At the Sixth Avenue side, at the 48th Street corner, will be the R.K.O. vaudeville, and at the 51st Street corner there will be built the R.K.O. picture theatre and offices of the corporation. Hiram Brown, President of R.K.O., would not commit himself to describing just what types of entertainment would be given at these theatres; he merely promised to provide "what the public wants."

All goods will be delivered to these buildings through subways, and underground parking space will be provided for automobiles. There is even a possibility that the 51st Street office building may be converted into a tower for parking cars.

Gateways through the buildings will lead into a central plaza of fountains and shrubbery, an island of restfulness secluded in the midst of the city.

On the subject of television, M. H. Aylesworth, President of the N.B.C., was very guarded, but it was gathered from his careful statements, made during the exhibition, that some commercial form of television receiver is expected to emerge from the R.C.A. laboratories by the time the new buildings are ready. Asked about the nature of the television broadcasts, and if all programs would be televised, he declared that not all programs are suitable for television, that some programs are best left to appeal to the ear alone. He also gave a strong hint that the first television broadcasts will consist of talking films, and not direct pick-ups from the studios or R.K.O. theatres.

The work of clearing the site for the new entertainment centre has already begun, and construction work on the central broadcasting building and R.K.O. theatres will commence in June of this year. The buildings will be complete and ready for occupancy on May 1st, 1933. The entire project is expected to be complete by 1934 or 1935. The nine separate buildings will have 28,000 windows and 125,000 tons of structural steel will go into their skeletons. The work will give employment, scattered all over the country, to about 25,000 men. The central building will contain 2,000,000 square feet of usable floor space, which is 150,000 square feet more than the Empire State Building, at present the world's tallest building. The entire centre will house 50,000 people.

Although the plans are not in their final form, they are described by the architects as being "near enough." Skyscrapers such as these have to be designed primarily around an elevator battery, with due regard to intricate and rigid building laws, and with regard to light and air. Once these considerations have been met, the beautification of the exterior can be proceeded with, so it may be expected that the buildings, in their final form, will look somewhat more pleasing than they do in the model. Even so, it is reported that, owing to wide-spread criticism which the appearance of the present model has aroused, the architects are building another model embodying certain suggestions which have been made.

For some months past, conflicting rumors have prevailed concerning the possible future connection with the new centre of S. L. Rothafel (Roxy), the popular broadcaster and entertainment producer. These rumors have at last been set at rest by the definite announcement by Mr. Brown that Roxy starts work on April 1st, 1931, as major domo of the two R.K.O. theatres.

An Electric Floor Waxer You Can Make

(*Continued from page 145*)

reversing lever by which the motor can also be stopped.

Ten layers of muslin were wrapped about the drum without wrinkles, then tacked down as shown, with the heads well below the surface to prevent scratching the floor. A groove can also be cut and the tacks set well below the surface. The nice thing about using laps of cloth is that when the outside layer becomes too soiled, it can be cut off and an entirely fresh layer is available.

Providing the motor you use is powerful enough, there is no reason why this outfit cannot also be used to sand floors by covering the drum with fine sandpaper.

The design and construction are simple and sturdy. If you use another type of motor, mount a switch on top of the motor block just back of the motor by boring a small hole down to meet the cable and running one cut wire from this to the switch. This is not necessary but it will prevent the necessity of pulling the plug to stop the motor.

The Life History of a Splash

(*Continued from page* 113)

There is the additional difficulty of timing the shutter to the desired fraction of a second, whereas the electrical spark presents no such obstacle. In photographing ordinary splashes super-high speeds are not encountered, so the oscillatory spark need not be damped. The gap constitutes sufficient resistance. The apparatus consists first of an ordinary source of alternating current, which is transformed to about fifty thousand volts or more, and then rectified. In the absence of a kenotron a large X-ray tube was used as a rectifier. A plate glass condenser of about one-fiftieth microfarad was charged, and the light from its discharge across magnesium terminals exposed the plates in the camera. This discharge gave a whacking big fat spark, which could be heard all over the lab.

In series with the lighting gap was placed another, the timing gap. Two hinged platforms were made, one for a copper ball, the second for the drop or ball to be photographed. The platforms, actuated by springs, were held horizontal by magnets, until the magnet circuit was broken, when the platforms fell down and away from the balls, leaving them in thin air, at exactly the same instant. The copper ball fell down between the terminals of the timing gap, and with the proper adjustment of the two gaps, the spark would jump across the gap when the ball shortened the air space in the timing gap. It could be raised or lowered so that the spark could be produced at any instant.

Stereoscopic Camera Used

Various mirrors and lenses were tried around the lighting gap, but the procedure varied with each different splash and angle of the camera. A stereoscopic camera was built and placed ten inches from the splash, the twin lenses being about four inches apart. With this greatly exaggerated perspective many who looked at the stereoscopic photos were unable to see straight for a considerable period thereafter.

Mercury, having high surface tension and density and being very reflective, is a good liquid to use. It photographs easily, forms characteristic splash, and is easy to handle.

In the series a drop of mercury 2 mm. in diameter is dropped 54 cms. into a pool of the same substance. The velocity on impact is 320 cms. per second. The drop flattens and inverts itself on impact, throws up a circular wall, which, falling back, throws up a center column. This column becomes unstable, surface tension breaks it and falling back it sends out a ripple.

Number 1 was taken about .00015 after impact.

Number 2: Time, about .0003. The reader can easily verify these times. Knowing the velocity and diameter of the drop and its distance through the surface, simplest arithmetic gives the answer. A single photo makes it hard to exactly judge the depth to which the drop has penetrated, which is where stereoscopic views are of assistance. Later times are determined by the timing gap.

Number 3: Time, .003 after impact. The wall is thin enough yet to be rather unstable for some distance below the top; hence the striations due to surface tension.

Number 4: The hollow is being enlarged, the walls spreading and thickening. Time, .005 after impact.

Number 5: The wall has already started back down. Time, .014. The effect of surface tension is well shown. The ripples around the base of the wall do not appear until the wall is falling back.

Number 6: The wall falling; occasional interference bands may be seen among the ripples. The wall is fairly stable, thick as it is, and the striations are absent. In a stereoscopic view one obtains a very satisfactory "feeling" as to the depth of the hollow, and the tiny drop above stands out very well. The time is .02, or one-fiftieth of a second after impact.

Number 7: The subsiding wall seems to be a trifle angular. As the mercury flows back down, the surface tension tends to hump it up in spots just as it tends to break up an unstable column at regular intervals. This may also be connected with the interval between columns shot out from the top of the wall, for in Number 6 can be seen the humps formed by the tiny columns that failed to break free from the wall. Time is .023 after impact.

Number 8: The mercury from the wall, falling back centerwards, has "met itself," and is starting a small column. Interference bands may be seen, and the ripple at the base of, or part of, the wall retains its angularity. Time is .034 after impact.

Number 9: The column is at the top of its rise, which action took place .066 seconds after impact. Actually this photo was taken a bit after the column had started back downwards, which is indicated by the pronounced neck that has formed. The surface tension seems unable to break up a column that is in motion unless it is very thin, for as long as the mercury has a definite current upwards it is not unstable. The "plateau" formed by the descending column is obviously conical.

Number 10: The neck snaps in two, leaving the drop free; the rest of the column has surface tension hauling it down as well as gravity. Time is .071 after impact.

Number 11: The column has produced another small hollow, and the drop is still on its way down. This drop is bigger than the original drop, but doubtless contains practically all the mercury that went to make up the original drop. Numbers 1 and 11 are on the same scale. The big column is drawn down rapidly, since it fails to break up. Time is .110 after impact.

Fascinating-Profitable

LEARN TELEGRAPHY This Easy Way—

CARNEGIE—world-famous ex-telegrapher

Thomas A. Edison—Andrew Carnegie—most of the presidents of railroads and other world leaders got their start as Telegraphers.
Today—on land—sea—in the air, men who know the code are commanding big money—in the world's most fascinating profession.
Learn AT HOME—with TELEPLEX—the Master Teacher. *Write for Folder E-6.*
Teleplex Co. 76 Cortlandt St., New York

Teleplex

CHEMISTRY

Learn at Home

THE Chemical Industry now ranks fourth among the industries of the United States and it offers a splendid opportunity for ambitious men.

One of the best ways for you to prepare for a good position in this fascinating field is through the home-study courses in Chemistry offered by the International Correspondence Schools.

These courses are complete and practical because they were prepared by some of the best-known chemists in this country, including:

ALLEN ROGERS, B.S., M.S., Ph.D.—Head of Department of Industrial Chemistry, Pratt Institute.

ANDREW M. FAIRLIE, B.S.—Consulting Chemical Engineer for the Tennessee Copper and Chemical Corporation; American Zinc, Lead and Smelting Co.; American Zinc Oxide Co., and the Baugh Chemical Co.

L. M. TOLMAN, Ph.D.—Formerly Chief Chemist, Wilson & Co. Now Vice-president, United Chemical and Organic Products Co.

OWEN L. SHINN, Ph.D.—Professor of Applied Chemistry, University of Pennsylvania.

Qualitative and Quantitative Analyses Outfits are supplied with these I. C. S. Courses at special prices for your laboratory work at home, and the courses are so arranged that you get just the help you need to secure a good position in the work you like best.

Mail the Coupon for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6163-G, Scranton, Penna.

Without cost or obligation, please send me one of your booklets, and tell me how I can qualify for the position or in the subject *before* which I have marked an X:

☐ Analytical Chemistry
☐ Chemical Engineering
☐ Industrial Chemistry
☐ Metallurgical Chemistry
☐ Analytical and Industrial Chemistry
☐ Short Chemistry Course
☐ Pharmacy

Also courses specializing in the Chemistry of the following industries

☐ Manufacture of Leather
☐ Manufacture of Cottonseed Oil
☐ Manufacture of Petroleum
☐ Manufacture of Sulphuric and Hydrochloric Acids
☐ Manufacture of Iron
☐ Manufacture of Steel
☐ Manufacture of Sugar
☐ Manufacture of Soap
☐ Manufacture of Cement

☐ Architect
☐ Architectural Draftsman
☐ Building Foreman
☐ Concrete Builder
☐ Contractor and Builder
☐ Structural Draftsman
☐ Structural Engineer
☐ Electrical Engineer
☐ Electrical Contractor
☐ Electric Wiring
☐ Electric Lighting
☐ Electric Car Running
☐ Telegraph Engineer
☐ Telephone Work
☐ Mechanical Engineer
☐ Mechanical Draftsman
☐ Machine Shop Practice
☐ Toolmaker
☐ Patternmaker
☐ Civil Engineer
☐ Surveying and Mapping
☐ Bridge Engineer
☐ Gas Engine Operating
☐ Automobile Work
☐ Airplane Engines
☐ Plumber and Steam Fitter
☐ Plumbing Inspector
☐ Foreman Plumber
☐ Heating and Ventilation
☐ Sheet-Metal Worker
☐ Steam Engineer
☐ Marine Engineer
☐ Refrigeration Engineer
☐ R. R. Positions
☐ Highway Engineer
☐ Mining Engineer
☐ Navigation ☐ Assayer
☐ Iron and Steel Worker
☐ Textile Overseer or Supt.
☐ Cotton Manufacturing
☐ Woolen Manufacturing
☐ Agriculture ☐ Fruit Growing
☐ Poultry Farming
☐ Mathematics ☐ Radio

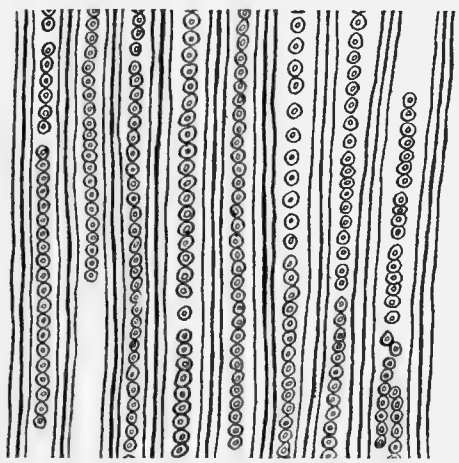
Name .....
Street Address .....
City ..... State .....
Occupation .....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

Forests of Stone

(*Continued from page* 129)

There are several notable facts to support this theory. First, not a single tree of all the thousands in the Petrified Forest has been found upright in its original position, but all lie prostrate, profusely scattered over the plains, lying on steep hill-slopes and piled up in dry ravines—logs disinterred from the high, eroded rock stratum in which they were deposited. Secondly, the trees are invariably barren trunks or logs without branches or leaves. Furthermore, the logs are not spread equally over the entire Petrified Forest reservation, but, as previously mentioned, are assembled within four separate, quite limited areas; hence the conception of an eddy. The rock bed in which the logs were entombed is like a river's deposit of sand and gravel consolidated by pressure and later uplifted by earth movement. The rock exhibits a striking criss-cross lamination or "cross-bedding" that definitely indicates deposition of the sediment by quick, shifting currents.



A sketch of Arizona fossil wood under a microscope (after F. H. Knowlton). Living trees of the pine family have similar tissues.

The process by which the wood of the buried trees became "petrified" consisted of the complete replacement of every minute particle of woody matter by a particle of the mineral quartz. Quartz, which is composed of silica or silicon dioxide, is the commonest solid substance on the surface of the earth. It forms the glassy grains of sand on the beach; it is one of the principal constituents of rocks, especially granite and sandstone; it forms rich veins that are sources of gold and silver; its varieties include such familiar names as amethyst, flint, jasper, agate, onyx. Quartz is an extremely hard mineral, so hard, in fact, that a steel knife will not scratch it.

Rain waters, percolating down through the open spaces of the sandstone beds in which the trees lay buried, probably dissolved considerable quantities of the silica of which sandstone is composed. The water permeated the porous logs, and, as the organic matter very slowly decayed, it was replaced, molecule by molecule, by silica, with the retention of every detail of the wood-structure.

The process of replacement is not a rare phenomenon; on the contrary, it is a common occurrence in nature. Any solution containing salts or gases, guided by fissures or open ducts, is capable of attacking and replacing even the densest of rocks. Limestone is especially subject to replacement by copper and lead minerals; many rich ore deposits are formed in this way. If granite itself may be replaced by certain minerals, with what ease may decaying wood be affected!

The beautiful coloring of the petrified wood is due to a small percentage of impurities. Iron-oxide colors the quartz red, and manganese-oxide colors it black. The deep, translucent red quartz of the petrified trees is called carnelian; the dull red and brown is jasper; the gray is chalcedony; a mixture of these minerals is called agate. Wind-blown sand has polished fragments of petrified wood to gem-like brilliance.

The long logs have broken into cylindrical chunks, square-ended as if sawed, a tendency which is attributed to the weakness of any cylinder along its transverse section—its vulnerable place, like the heel of Achilles.

As the erosive action of wind and running water has slowly carved the Petrified Forest region into a series of mesas, ridges, plains and steep ravines, the high rock-bed in which the logs were originally buried has been slowly worn away, and the logs have rolled down to lower levels and have been broken.

View of the base of a large petrified log, showing the excellent preservation of the form of the trunk.

If the supporting earth under the central portion of a recumbent log were washed away, the log would probably break of its own weight. This is illustrated by the famous Natural Bridge, a great petrified trunk 111 feet long, spanning a deep canyon cut under it by an intermittent stream. The log had begun to crack and had to be supported by piers, which have robbed the Natural Bridge of most of its popular appeal.

Finally, is is probable that the major cause of breaking has been the rapid alternating expansion and contraction due to the extreme change of temperature from the heat of day to the cold of night—a variation which, in the Arizona desert, may attain a range of 75°.

New Tools You Can Easily Make

(*Continued from page* 146)

lathes having lever feed tailstock spindles offer an improvement over this method, since the tap may be secured in a chuck which in turn is held in the tail spindle taper hole; this system insures the tap starting its thread cleanly, and working through the hole accurately.

As the majority of lathes have screw feed tailstocks, however, accurately threading small holes is not so convenient with ordinary equipment. Rarely is it possible to so time the feed that the tap enters with minimum effort. Of course, special tap holding attachments adapted to any lathe are procurable and serve efficiently, but the amount of work handled sometimes does not warrant their purchase.

The unusual and readily constructed small tap holder illustrated, not only admits of its usage with a screw feed bench-lathe tailstock, but it makes power-driving the work quite feasible: of course, the lathe's lowest speed is used. Were power-driving attempted with any of the tap-holding methods previously described, it would not be possible, ordinarily, to stop the lathe in time to avert either injury to the hand or destruction of the tap.

This improved device is comprised of few parts and it offers room for individual elaboration or further improvement. Any ordinary tap holder of good quality is procured, and it is altered to receive the centering and feeding attachment illustrated.

A sleeve shown in partial cross section is bored to receive the support shank with a snug running fit, while its outer end is tapered at sixty degrees to fit over the dead center. A fairly stiff spring is inserted, with two washers, between the tap holder and sleeve. While the cross handle may be replaced after force fitting the shank into the tap holder, a better plan might be to force a hand wheel over this part of the tap holder body.

In using, place the tap end into the hole, draw the dead center up to the sleeve end and compress the device until the spring is closed; then lock the tail spindle. Hold the handwheel or cross handle and start the lathe at its lowest speed. When the tap has penetrated sufficiently, release the handwheel or handle; the whole tool will then spin with the work.

Aerial Bullets and Bombs Will Decide the Next War

(*Continued from page* 115)

Strange to say, the pilot of the war plane aims his machine guns by steering his plane. This is a trick of the trade which must be mastered by the tyro before he can advance measurably in the field of aerial gunnery flying. The supreme trick in aerial gunnery is for the pilot to fly his gunsights at the target instead of actually piloting the plane which he drives at that target. These sights consist of beads and notches mounted on a bar in front of the pilot or forward gunner. The rear gunner in the plane is provided with special gun sights adapted to his position.

The U. S. S. New Jersey after it had been struck by a 2000-pound demolition bomb.

There are several concentric rings yoked for firing service as a part of the sights on the pilot's guns. One of the sights on the flexible gun mount is a wind vane which is swung off center by the strength of the wind blast, and thus compensates for the movements of the combat plane. This compensation is such that although the gunner may aim by means of his bore sight at the enemy plane flying in the opposite direction, the fire if gauged correctly will disable the pilot of the adversary ship. An experienced gunnery pilot only fires when on the target, while he always holds enough ammunition in reserve to safeguard his homeward flight.

A ground machine gunner is as much at sea in air fighting from a plane as a transport pilot is when transferred to a war plane and tested out as an aerial gunner. The Air Corps reports that it is simpler to train an aeronautical mechanic who is air-wise as a gunner than it is to break in a schooled machine-gun operative from infantry or artillery detachments to the upper atmosphere style of combat.

The fighting aircraft of modernity are equipped with the latest types of bomb sights, which measurably improve the accuracy of aviational marksmanship in dropping bombs on both stationary and moving targets. These new sights take into consideration such important factors as the speed of the plane, the velocity and direction of the wind, as well as the direction in which the plane is traveling, the time lag of the bomber, the time required for the bomb to reach the target and the altitude at which it was released. These sights are really the mechanical brains, endowed almost with the wizardy of human intelligence, which increase the effectiveness of aerial bombing warfare.

High altitude bombing is very successful against large objects, such as ships at sea, metropolitan buildings, warehouses and the like. Such bombing can be carried on with the efficient aid of the bomb sights at altitudes of 8,000 feet or higher. In intermediate bombing the bombing plane drops its missiles from altitudes of about 5.000 feet. Practical tests have divulged the interesting and important information that bombs dropped in the water near enemy ships are more effective as destroyers than similar explosives which fall directly on the vessels. The tremendous force of the bomb exploding in the water, so to say, transfers to the water — a non-compressible medium — enormous destructive power. The water assails the neighboring ship much as would a gigantic hammer actuated by invisible power to crack it to pieces.

The trajectory of a falling bomb is such that its progressive positions during its descent are always directly below the plane from which the projectile was released. Airmen conduct their bombing activities on the basis of demonstrated mathematical formulæ. For example, the time in seconds required for a bomb to fall upon the target at which it is aimed is always equal to the square root of the altitude in feet divided by four. That is to say, a bomb released at an altitude of 10.000 feet will require 25 seconds to reach the object at which it was launched from the upper atmosphere.

Scarcely anyone today doubts that the next war will be decided in the air. Bombs of all types, smoke screen, armor piercing, shrapnel, incendiary, asphyxiating and tissue destroying gases and disease-bearing — will be rained down upon the enemy from the skies, dealing widespread death and destruction. Swiftness and the element of surprise will be the keynotes of such aerial attacks, so that the enemy will be disorganized, demoralized and destroyed before he has time to take counter measures.

$21,000.00 FOR SPIRITS

For more than six years this publication has offered prizes totaling $21,000.00 for genuine demonstrations and proofs of spirit manifestations which we cannot duplicate by scientific and well-known means.

Up to the present time not one manifestation has been presented which by even the greatest stretch of the imagination could be considered genuine.

How many more years must this prize be offered? Spiritualists, please answer!

A HEALTHFUL

adventure

A trip to Chalfonte-Haddon Hall is a grand lark for the whole family . . . and a lark that is full of health, as well as happiness. Here they can absorb the sun . . . breathe deep the tonic ocean air . . . satisfy keen appetites with wholesome, tempting food. In the background is always the comfort and informal hospitality of Chalfonte-Haddon Hall, with its many facilities for relaxation and recreation. Come for a short vacation, or a long one. We will be glad to send you further information.

American and European Plans

CHALFONTE-HADDON HALL

ATLANTIC CITY

Leeds and Lippincott Company

Be a Traffic Manager

Big Pay—Big Opportunity

Big business needs trained traffic men. At least three Detroit manufacturers pay their traffic managers better than $20,000 a year. Train in your spare time for this highly profitable profession. Low cost; easy terms. Write now for valuable 64-page book—FREE.

LaSalle Extension University, Dept. 6384-T, Chicago

HOME STUDY Training Program

LAW

Write today for new Free book. It tells you how a law training will shorten your road to success. It also carries a vital and inspiring message to every ambitious man. Find out about the opportunities that await the law trained man. Find out how you can learn law right in your own home. No obligations. The book is FREE. Write today.

American Correspondence School of Law 3601 Michigan Ave., Dept. 142-A, Chicago, Ill.

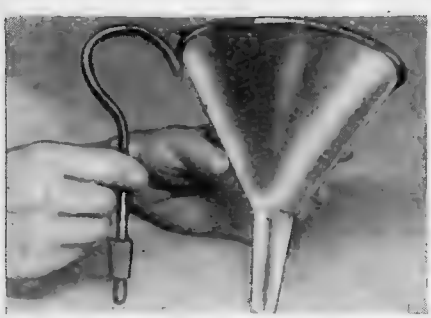
An Experimenter Stunts with Atmospheric Pressure

The Air in Which We Move So Freely and Safely Is Responsible for Many Interesting and Useful Phenomena

By Raymond B. Wailes

EVERY inch of your body is being pressed upon by the air about you with a weight as great as fifteen pounds! A striking experiment which can be performed to show this pressure consists in boiling water in a partly filled can, screwing on the top and holding the can under the cold water faucet. The can will collapse to a deformed shape pushed inward in the case of the first part by the external air pressure as illustrated. The steam drives out the air from the can, and the cold water condenses with steam, forming a vacuum inside the can. The air outside the can then presses upon the sides of the can to crush it.

A stoppered toy balloon has the air inside it at normal pressure—15 pounds per square inch. If the balloon is placed inside a bottle and the air sucked from the bottle, the balloon will blow up, the air pressure inside being greater than that outside of the balloon. The same phenomenon can be demonstrated in another way with a sealed balloon. The balloon is introduced into a chemical flask containing water which is subsequently boiled. The flask is then tightly closed by means of a stopper. When the flask cools a partial vacuum is formed within it. This is less than fifteen pounds per square inch. The air within the balloon then expands and distends the balloon. If the flask is made of Pyrex it can be safely cooled in cold water.



The old parlor trick of filling a tumbler with water, topping with a sheet of paper and then inverting the whole without spilling a drop of water is accomplished by the pressure of the air pushing up on the paper from the bottom, holding it against the mouth and refusing to allow the water to come out.

Above—Air bubbles carry water with them. Left—Reducing pressure expands the balloon.

A curious scientific toy called the intermittent fountain can be made by bending a metal pipe in the shape of a question mark and thrusting it through a cork which fits into the stem of a funnel from the upper end. If the water is admitted to the funnel it will slowly fill up, eventually running out through the metal tube until the water level inside falls to the level of the end of the tube. Air will then enter the tube, breaking the flow, and the funnel will fill up again, only to make repeated dumpings at regular intervals. Some natural springs operate in a similar manner.

As the pressure increases with the depth of the liquid the drop of ink will rise in the tube.

Water can be lifted from depths by blowing air down through a tube or pipe contained within a large pipe which is immersed in the water. The air bubbles upward through the water and carries the water with it in slugs, or broken streams of air and water. This experiment is easily duplicated with a few cents worth of glass tubing, or a cardboard tube and a soda straw assembled as shown.

Left — The puzzling intermittent syphon can be simply made.

In this case air pressure offsets the weight of the water.

Pressure increases with the depth of a liquid. This fact can be shown by tying a piece of rubber balloon across the blown end of a funnel (thistle funnel), fastening a scale to the stem and inserting a drop of ink in the stem. As the funnel is pushed downward into water the rubber skin is pushed in and the drop of ink moves upward along the stem.

Here is what air pressure did to this tin can. If in some way the pressure within us were suddenly reduced, our bodies would similarly collapse.

Inducing Sleep

IT is not generally known that certain colored lights have the tendency to put us to sleep, but it is nevertheless true that colored lights can at times act on the human system in a very powerful way.

If you are bothered in getting to sleep at night, get a small 15 or 25 watt electric light bulb and color it violet color, (a good coloring for this is violet strawhat dye) this light if left burning when you retire will make it almost impossible for you to keep awake.—*Guy E. McAllan.*

Byrd's "Little America" Reproduced for the Movies

(*Continued from page* 126)

over the entire equipment of the Lakehurst, New Jersey, training school, to Columbia Pictures Corporation, for use in a picture depicting the story of the lighter-than-air department of the Navy, and with Director Frank Capra as commanding officer, the mammoth ship was put through its paces for the camera's benefit. A daring cameraman leaped from its gondola to make a photographic study of two men who were floating down to earth on parachute wings. A plane flew beneath the *Los Angeles,* attached itself to the dirigible's framework, and was borne along in its flight, later taking off again for a separate landing. Under the skilful handling of its crew, the giant of the air was made to re-enact, as nearly as possible, the "crack-up" of the ill-fated *Shenandoah.* The missing shots that could not be produced were made later with a 25-foot model of the *Los Angeles,* controlled by the radio system invented by John Hays Hammond.

Note the Sperry gyroscopic stabilizer with which this camera is constantly kept in position.

Compressing the story of the Byrd Antarctic expedition, the destruction of the *Shenandoah,* and Captain Frank Hawks' transcontinental flight, into a single narrative, the story opens up the interesting question of the possibility of a dirigible flight to the South Pole. Naval authorities believe the feat possible provided a "mother ship" such as the *U. S. S. Lexington* were to accompany the expedition as a base for the last lap of the polar flight. Such an expedition is used as a basis for the film plot. Copies of the picture are to be preserved in the archives of the Congressional Library at Washington.

A Work Bench from an Old Bedstead

(*Continued from page* 150)

becoming nicked or dulled by scraping over the bolts in the top of the bench, countersink them, smear some glue in the holes and drive small, snug-fitting pegs in the holes after the bolts have been tightened. If the head of the bolt is nearly flush with the top of the bench, fill around and over it with plastic wood and in either case finish the job by planing the top smooth. A coat or two of clear varnish or clear lacquer may be given the bench top or it may be left plain.

CIVILIZATION'S DIARY

CIVILIZATION is a manner of living—and civilized people seek to live as comfortably, healthfully and pleasantly as they can.

To this end, the wheels of industry turn unceasingly, producing civilized goods for the use of civilized people. Leaders of industry lay far-reaching plans to provide better services for a civilized world. In countless laboratories, new things and better ways are constantly being developed.

Advertisements are the daily record of civilization's progress. They are civilization's open diary —brought to you in the pages of this magazine. Diaries make good reading, and the advertisements are no exception. Read them every day . . . and keep posted on the things that make civilized living ever more livable.

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. The dealer will then be in a position to supply copies to you regularly every month. If you are interested in reserving your copy every month, do not fail to do this. It costs you nothing to do so.

AMAZE & MYSTIFY!

BIG MAGIC BOOK FREE!

Be Popular—Learn to Entertain

My famous "Book of 1000 Wonders" now sent Free! Hundreds of tricks require no skill. You can do them. This book describes effects for Pocket, Parlor or Stage, all easily learned. Also Puzzles, Jokes, and Imported Novelties. Large assortment, lowest prices. You will amaze and mystify your friends. Write today!

LYLE DOUGLAS, Station A-3, Dallas, Texas.

DRAFTING—*Learn at home*

Mail Coupon for Free Booklet

F. E. King was "a poorly paid clerk" when he enrolled for the home-study Drafting Course of the International School of Drafting. Through study and perseverance he became Chief Draftsman of the U. S. Steel Furniture Co. He is now earning more in a day than he used to earn in a week. A. J. Hutchins became Chief Draftsman for the American Strawboard Company and increased his salary 300%. There is no doubt that Drafting offers a real opportunity to ambitious men and it will pay you to investigate it.

INTERNATIONAL SCHOOL OF DRAFTING
Division of the International Correspondence Schools
Box 6165-G, Scranton, Penna.

Without cost or obligation, please send me full details of your home-study course in

☐ Drafting ☐ Civil Engineering
☐ Mechanical Engineering ☐ Architect
☐ Contractor and Builder ☐ Architects' Blueprints

Name..... Age .....

Address.....

Span the World with this Set!

A new radio thrill for you! Listen in DIRECT to London, Paris, Berlin, Buenos Aires and other broadcasting stations throughout the world via short waves. Enjoy unique foreign programs from strange lands. Your ordinary receiver cannot tune in these low wave stations. WORLD-WIDE RECEIVER gets 14 to 550 meter stations with surprising clarity. **SEND NO MONEY!** Just write your name and address on a postcard and ask us to send you this wonderful guaranteed short wave set. Pay postman $6.45 plus a small delivery charge. All orders West of Rockies must be accompanied by $1.00 deposit. Price in foreign countries $7.75 delivered. Order today!

NEW RADIO BARGAINS

Low Power Transmitter adaptable for phone or code. With plug-in coils $14.75
B Eliminator, Bone Dry, with 280 tube, 180 volts, will operate up to ten tube set, fully guaranteed. 6.75
AC—A B C power packs 8.75
Tubes: UX type, 30-day replacement guarantee, No. 210, $2.25; No. 250, $2.35; No. 281, $1.85; No. 245, $1.25; No. 224, $1.25; No. 227, 75c; No. 226, 65c; No. 171, 75c.
International Microphone, two-button, for public address systems and transmitters, speech or music $9.75

WRITE FOR BARGAIN CATALOG
CHAS. HOODWIN CO.
4240 Lincoln Ave., Dept. F-3, CHICAGO

A Flexible Shaft You Have Always Wanted
At an Unheard of Price

Has a thousand uses, for grinding, polishing and buffing. Flexible shaft complete with 1—4" sewed buff, 1—4" loose buff and 1 4" wire scratch wheel. Motor shaft coupling can be furnished from ⅛" to ½". State motor shaft size.

$1 Deposit on C. O. D. Orders
FLEXO SALES COMPANY
158 N. Desplaines Street Chicago, Illinois

CHEMISTS

Catalog illustrating 2500 Chemist's Supplies, 5,000 Chemicals, Minerals, Drugs, etc., and listing 1,000 scientific books sent for 50c. Glass Still as illustrated. Capacity of flask 1 qt. Complete $8.

LABORATORY MATERIALS CO.
635 East 71st., Chicago, U. S. A.

In the June Issue
of AMAZING STORIES

THE INCREDIBLE FORMULA, by Paul Ernest. For ages man has attempted to emulate nature in the creation of life, but has thus far failed pretty miserably. If he should finally succeed some day in prolonging life, or even, with the use of remarkable formulas, in restoring the action of the heart, which is supposed to be the seat of life, what then?

THE TIME FLIGHT, by Miles J. Breuer, M.D. "Anything that the human mind determines upon with sufficient intensity can be done." With that thought deeply impressed upon his mind, our very young scientist in this story does the seemingly impossible. All his scientific problems seem almost to solve themselves. And thanks to Dr. Breuer's ability as a writer, these problems become simplified for us.

THE POWER PLANET, by Murray Leinster. The best way we knew of to answer the many questions as to why we did not publish another story by Murray Leinster, was to publish one. We are glad to announce that this is one of Mr. Leinster's best.

THE BEAUTIFUL BACILLUS, by Patrick Dutton. Bacilli are exceedingly interesting forms of life to study through the microscope. But too much success with experimenting with them has its grave dangers . . . as witness what happens to Professors Polen and Glissop in this story.

ACROSS THE VOID, by Leslie F. Stone (A Serial in Three Parts), Part III. The concluding chapters are most absorbing and fast-moving in their account of the adventures of our friends from Abrui on the Planet Kal, inhabited by the beautiful Butterfly-like creatures.

Other unusual scientific fiction.

Harnessing the Tides

(*Continued from page* 125)

of its volume is filled with water. This water is made to circulate by a pump through the water brake and so becomes heated and then returns to the boiler.

The steam from this boiler drives a Laval steam turbine of 52 k.w. capacity running at 5,000 r.p.m., geared down to 1500 r.p.m., and this in turn drives an alternator of the same size as that on the head of the friction brake. (See sketch.)

The main shaft of the water turbine is connected by gearing with a speed governor and a centrifugal pump which circulates the water through the brake. The governor acts through an oil relay and controls a balanced piston valve which in turn controls the amount of water passing through the brake.

If the speed of the main vertical shaft increases, the governor then increases the rate of flow of the water through the brake and this puts a greater load on the shaft and checks the speed, and, *vice versa*, if the speed falls, the amount of circulating water is decreased. This governor holds the speed constant at 500 r.p.m.

This being the arrangement, the next consideration is the efficiency of it in capturing the tidal energy. When water is lifted above the mean ocean level work has to be done which is reckoned in foot-pounds. When this water falls down again it gives up energy at a rate depending on the rate of fall.

It is useful to remember that 3 cubic feet of fresh water weighing 186 pounds, when falling at the rate of 3 feet per second is equivalent to 1 horsepower. This is the theoretical amount of work. If that water falls through a turbine we can obtain on the turbine shaft about 80 to 85 per cent of the theoretical power.

Hence, 30 cubic feet of water falling through a turbine at the rate of 30 feet per second will yield about 85 horsepower on the shaft.

The next question is: How much of this power does Mr. Shishkoff's method enable us to use?

The Avonmouth plant was built to enable an exact answer to be obtained to this question. Tests were therefore made during July and August, 1930, by an eminent British firm of consulting engineers, Messrs. Kincaid, Waller, Manville and Dawson, and the result of their examination was to show that 70 to 72 per cent of the turbine output could be captured either as heat in the boiler or as electrical work done by the steam-driven alternator.

This shows, therefore, that about 60 per cent of the total tidal power can be extracted in a form immediately capable of use.

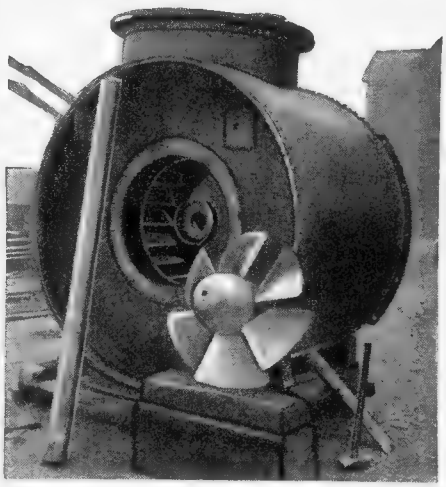
Mr. Shishkoff considers that by this method it will be possible to generate electric power at the cost of about half a cent per kilowatt-hour by a large plant of about 9,000 horsepower.

It is possible to augment the heat accumulation in the boiler by assisting the brake to a certain degree by steam from a fuel-fired boiler which will operate during slack water, the inactive period of the tide.

The result of this Avonmouth experiment has therefore been to open the way for estimates to be made for a much larger scheme.

The Electricity Commissioners of England, which is a body charged with the duty of coördinating and extending the use of electric power in Great Britain, have on hand a scheme for covering the country with a network of supply lines called "the grid," into which a number of generating stations will discharge their electric current, and then from the grid it can be tapped off at any point required. But all schemes of electric power supply have to take into account the variable load factor.

The demand for electric energy varies very greatly during the 24 hours of the day and runs up to a peak once or twice a day. The generating plant, therefore, has to be large enough to meet this "peak" demand, though the greater part of it is not required for the rest of the time.



The 300 H.P. water turbine, showing the casing and runner.

Studies are now being made of a plan on a much larger scale, by creating a tidal catch basin on the Welsh side of the Bristol Channel to have an area of 12½ square miles by building a dam wall 5 miles long. This would not interfere with the navigation of the Severn. It would provide, when equipped with Shishkoff plant, for producing 700,000,000 kilowatt hours per year at 50 per cent load factor and a peak of 160,000 kilowatts. The cost is estimated at 30 million dollars.

This plant would assist the South West of England "grid" by taking the peak load.

A preliminary project has also been worked out for the river Rance in northern France.

On the whole, therefore, we seem now to be within reach of a practical method of using the tides.

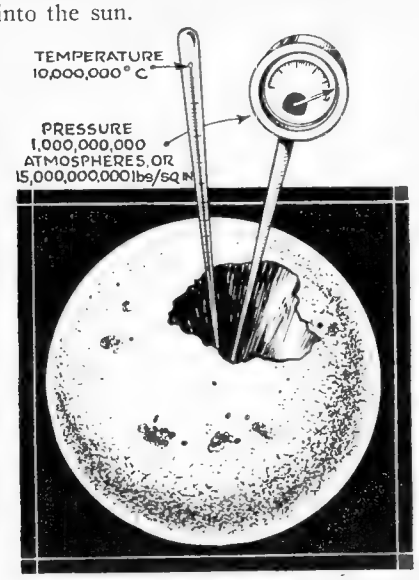
The sun and moon are primarily regarded as our natural luminaries; but we appear to be about to make use of them through the tides to generate artificial light for us as well.

What Makes the Sun Hot?

(*Continued from page* 121)

solar energy, stored up by natural processes in ages past. Wind? Air currents and ocean currents are produced by direct solar action and would terminate with the death of the sun. Tides? We frequently hear rumors of harnessing tidal power, though no practicable system appears as yet to have been developed. Certainly, the gravitational attraction of the moon and sun does not depend on their continued shining, but no appreciable power could be derived from tides in a frozen ocean. All forms of animal and vegetable life depend upon the sun for their existence. It is fortunate for us that the death of the sun, inevitable though it is, is probably a matter of the far distant future and that its demise will be probably gradual rather than sudden.

The solar engine is generating energy at the rate of twenty-three octillion* horsepower, about fifty-three horsepower for every square inch of solar surface. This amount of energy is enormous. If, by some miraculous means, we could incase the sun in a shell of ice half a mile thick, the radiation, struggling to escape, would completely melt the shell inside of an hour, and within several hours more would entirely convert it into steam. Even more impressive is the length of time the sun has been shining. Geological records extend back a billion years or so, during which time the rate of solar radiation has been practically constant. What is the source of this heat? To find the answer it is necessary to delve deeply into the sun.



Estimate of the sun's internal pressure and temperature.

If the sun were a great sphere, at approximately uniform temperature throughout and with no heating system to replenish the energy lost by radiation, we should have noted a perceptible cooling within historical times. Probably the sun is much hotter inside than on the surface, but in the most extreme case the total supply of heat stored in the solar interior could keep the sun going for not more than ten or twenty million years.

Perhaps the next thought may be that the heat replenishment is due to combustion. Exact calculation, however, shows that if the sun were composed of the highest grade coal mixed with pure oxygen in the correct proportion, complete combustion would provide energy for less than 2,000 years of solar radiation. Quite aside from this inadequacy, it is of interest to note that the sun is actually *too hot to burn!* If a mass of carbon dioxide, the product of combustion, were to be transferred to the sun, the gas would dissociate into its constituent atoms, oxygen and carbon, under the influence of the high temperature. The carbon would remain in the gaseous state, not hardening into coal or other solid form of the substance. Combustion is a special sort of chemical reaction. Though a few chemical processes may release more heat than normal combustion, all of them fall far short of accounting for the vast volume of solar radiation.

When the discovery that heat can be produced by mechanical action was made, it was suggested that the sun was kept alive by the impacts of meteors striking against the surface. Again exact calculation spelled the doom of an ingenious theory. Not only would the number of meteors required be far in excess of the observed number, but the growth in weight of the sun would be rapid enough to cause appreciable gravitational disturbances.

Then came the most famous theory of all, that of Helmholtz. It is well known that heat can be generated by compression. (Note how hot the barrel of a tire-pump may get.) If the sun is contracting, the resulting compression will tend to produce heat. Helmholtz calculated that a decrease of but 140 feet per year in the solar radius was all that was needed to "stoke" the solar fires. This would have sufficed to keep the sun shining at its present rate for ten or fifteen million years. Helmholtz, at the time, warned the geologists not to exceed this figure for their determinations of the age of the earth. Disregarding the warnings, scientists have since discovered important and apparently irrefutable evidence that the earth is a couple of billion (2,000,000,000) years old—fully a hundred times greater than the limit set by Helmholtz—and the search for the source of solar energy goes on.

Radioactivity? The sun emits about two ergs‡ per second for every gram of its mass. A gram of pure radium produces about one million ergs in the same interval. Hence, even if the sun were composed of radium to the extent of only one part in 500,000, the *present* rate of solar radiation could be accounted for. But past and future difficulties remain as before. The life of a radium atom is limited. If, today, I have a gram of radium, 1730 years

*23 followed by 27 ciphers (In England, twenty-three thousand quadrillion).

‡The unit of energy. Forty million ergs are equivalent to one calorie, a more familiar unit.

It's FUN to USE

Boys, here's the strangest wood you ever saw! Makes and mends 1,001 things. Does everything that wood or modeling clay can do. You mould it like putty. Then when it hardens you can plane, carve, turn or paint it. It's actually wood—comes in 9 colors and is sold in cans and tubes by all paint, hardware and department stores. Ask for Plastic Wood.

Fill in and mail the coupon for big, 48-page illustrated book crammed full of interesting uses for Plastic Wood. Mail coupon today.

BIG 48-PAGE BOOK FREE

THE A. S. BOYLE CO., Dept. 6-SI
Cincinnati, Ohio

Send me—free—Big Book of Uses for Plastic Wood.

Name .....

Street .....

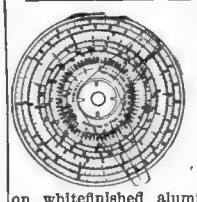
City ..... State .....

HOME-STUDY BUSINESS TRAINING

Your opportunity can never be bigger than your preparation. Prepare now and reap the rewards in earlier and larger success. *Free 64-Page Books Tell How.* Write *now* for book you want, or mail coupon with your name and address in margin *today.*

O Higher Accountancy	O Business Mgm't
O Mod. Salesmanship	O Business Corres.
O Traffic Management	O Credit and Collection Correspondence
O Law: Degree of LL.B.	O Modern Foremanship
O Commercial Law	O Personnel Mgm't
O Industrial Mgm't	O Expert Bookkeeping
O Banking and Finance	O C. P. A. Coaching
O Telegraphy	O Business English
O Rail. Station Mgm't	O Commercial Spanish
O Railway Accounting	O Effective Speaking
O Paper Salesmanship	

LASALLE EXTENSION UNIVERSITY
Dept. 694-R Chicago



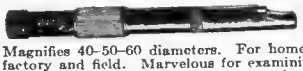
THE MIDGET SLIDE RULE

Instantly adds, subtracts, multiplies, divides, solves proportion, gives all roots and powers. Logarithms, Sines, Cosines, Tangents, Cotangents, etc. Also gives decimal equivalents, lettered and numbered drill and tap sizes.

The Engine-divided scales are on whitefinished aluminum and are grease and water proof. Diameter 4". Price with Instruction Book $1.50. Pocket Carrying Case, 50c extra. Cash or C.O.D. Catalogue free. Your money back if you are not satisfied.

GILSON SLIDE RULE COMPANY. Stuart, Florida.
(SLIDE RULE MAKERS SINCE 1915)

GIANT MICROSCOPE SEND ONLY $1



Magnifies 40-50-60 diameters. For home, office, factory and field. Marvelous for examining minerals, ores, textiles, and for nature study. A real precision microscope made by one of the leading makers. Mirror reflector lights object. Dust cap protects objective lens. Complete with pocket clip. Only $3.95. Send $1. Pay postman $2.95 plus small postage. Money back guarantee. Order now. Big catalog of optical and photo goods free. CENTRAL CAMERA CO., 230 S. Wabash Ave., Dept. 36A, CHICAGO

It's Time You Learned to Fly!

Today the world motors—tomorrow it will fly! As surely as you drive a car now, you'll be piloting your airplane before long. Business is using Aviation as a new tool, vitally important. It's time you learned how to handle this big factor in modern life.

Parks Air College is now and has been for 3 years the largest commercial aviation school in the world. It has qualified 1109 out of 1394 students. Highest standards, thorough and complete training, make a Parks diploma the biggest asset in aviation.

"Skyward Ho" is a big, interesting book that tells all about Aviation and your future. It's free—write for your copy.

PARKS AIR COLLEGE

Section 6-SI, Parks Airport
EAST ST. LOUIS, ILL.

WANTED BUSINESS BUILDERS

By underselling all others by half in ten world famous electrical specialty, replacement supply and service lines we maintain a double monopoly and a business made to order for this day and age. No pioneering necessary. Products long established by millions spent in advertising. Only responsible workers seeking lucrative line free from traveling or expense and who are able to finance themselves in a small way are wanted.

U-R-O-N INDUSTRIES
1305 Engineers Bldg. Cleveland, O.

DEAFNESS IS MISERY

Many people with defective hearing and Head Noises enjoy conversation, go to Theatre and Church because they use Leonard Invisible Ear Drums which resemble Tiny Megaphones fitting in the Ear entirely out of sight. No wires, batteries or head piece. They are inexpensive. Write for booklet and sworn statement of the inventor who was himself deaf.

A. O. LEONARD, Inc., Suite 685, 70 5th Ave., New York

Feel 10 Years Younger In 6 Days!

SCIENCE now knows that the tiny prostate gland frequently causes lost health and strength, night rising, constipation, pains in the back, legs, feet, etc., in men past 40. Unless corrected this may lead to miserable old age and grave surgery. Now an amazing drugless treatment is giving swift, permanent relief to thousands. Used and endorsed by physicians, hospitals and sanitariums. Sent on trial. Feel 10 years younger in 6 days or pay nothing. Write for offer and free book of daring facts about men past 40.

W. J. KIRK, Pres., 4542 Morris Ave., Steubenville, O.

WE MATCH PANTS To Any Suit!

Double the life of your coat and vest with correctly matched pants. 100,000 patterns. Every pair hand tailored to your measure; no "readymades." Our match sent FREE for your O. K. before pants are made. Fit guaranteed. Send piece of cloth or vest today.

SUPERIOR MATCH PANTS COMPANY
115 So. Dearborn Street, Dept. 591 Chicago.

BASHFUL?

"Shame on you!" Are you *nervous, embarrassed* in company of the other sex? Stop being *shy* of strangers. Conquer the terrible *fear* of your superiors. Be cheerful and confident of your future! Your faults easily overcome so you can enjoy life to the fullest. Send 25c. for this amazing book.

RICHARD BLACKSTONE
B-456 Flatiron Bldg. N. Y. C.

hence, owing to the radioactivity itself, I (or rather my descendants) should find myself in possession of but half a gram. The same condition must hold true for the sun. If solar heat is to be attributed to radium, 1730 years ago the radium content and, consequently, the amount of energy emitted must have been double the present values. Historical records are quite sufficient to prove that the doubling did not occur. We look over the list of radioactive elements. Uranium, which has a sufficiently long life, provides only one erg per gram per second, considerably short of the required amount.

And so on—for one reason or the other we have to reject all members of the series of heat-producing elements as possible sources of solar energy. Radioactivity cannot be responsible unless it be of a kind unknown to us. The system of atoms breaks off abruptly with uranium, number ninety-two. So far as we know, the only reason for this end is the probable greater instability of elements of still more complex construction. Jeans, the well-known English astrophysicist, supposes that these "super-radioactive" elements of higher atomic weight actually exist and are responsible for the solar energy. His theories, however, have not met with wide acceptance.

The Sun's Interior

Before trying to make further progress, let us discuss more fully the constitution of the sun. Sir William Herschel thought that the sun's heat was merely skin deep. He based this conclusion on the saucer-shaped appearance of sun-spots, which, by their blackness, were obviously cooler than the rest of the solar surface. He thought these dark areas were glimpses of a cold, possibly habitable world far beneath the shining clouds. We know definitely that this view is totally incorrect.

But how can we know the true nature of the solar interior, forever hidden from our view! The problem is not as hopeless as it seems, in spite of our inability to thrust a thermometer down the throat of the sun. Two clues are at hand. One we have already referred to—the escaping radiation. The other is the gravitational field that emanates from the interior, telling us how much material is inside the sun. Our task is to discover how this material is arranged. In the first place, we know that the temperature must increase inwardly, for a flow of heat can occur only when differences of temperature exist. Secondly, the farther we go into the interior, the greater the pressure (the weight of the overlying layers) must be. In order to keep the sun from collapsing under pressures, exceeding a billion atmospheres (fifteen billion pounds per square inch) it is necessary to suppose that the temperature at the center is at least 10,000,000° C. absolute.

High as these temperatures are, they are disappointing in that they provide no clue as to the energy source. Since no molecular or atomic action appears to be capable of furnishing enough heat, we seem to be driven to the view that the process is subatomic—and about the only reaction that could possibly evolve sufficient heat is actual *annihilation* of matter. Though the idea may have an ultra-modern ring, it was actually proposed three hundred years ago by Newton, who, in his *Opticks*, speculated on the possibility of the conversion of "light into bodies and bodies into light." The old suggestion was given quantitative form through the theory of relativity.

Solar Heat, the Result of the Annihilation of Matter

By *annihilating* a gram of coal, we could obtain several billion times more energy than by burning it. One drop of *annihilated* gasoline would furnish as much power as one-hundred tankfuls of the substance. Light (or heat) and matter are thus seen to be equivalent. A 1000-watt lamp would have to shine continuously for 5,000 years in order to radiate a single gram of light. We feel confident that solar heat is due to annihilation of some sort, though the details of the process are obscure.

At the high temperatures prevailing in the interior, the atoms and electrons are dashing about at tremendous speeds, colliding millions of times in a second. We like to think of a runaway electron smashing "head on" into an atom and blowing both of them up with a flash of light, but 10,000,000° seems all too small to have much effect on the process. It may be, however, that atoms are "loaded guns" of a sort; the amount of energy they give off in a single explosion is much less than that required to fire them. In this case, we should be able to reproduce and (we hope) control the process in terrestrial laboratories. But if Jeans is right, that the reaction is a kind of super-radioactivity, we are forever doomed to rely upon our present relatively feeble and inefficient sources of power. If our annihilation theory is correct, the sun has a store of energy ample enough for several trillions* of years at the present rate.

Theories come and theories go but the sun goes on (not quite) forever.

*3,000,000,000,000.

Scientific Aids to Your Comfort

(*Continued from page* 149)

add the proper amount of specially prepared non-explosive fluid, fasten the lid, and turn the tumbler for a few minutes. Remove the garment and allow it to dry. The most fragile curtains, laces and embroidered doilies may be washed safely. Use soap and water for cleaning cotton goods.

The washboard corrugations in the surface of the can assist the cleaning process. The unit is electrically welded and rustproof. Tested and approved in our laboratory.

brighten up the appearance of the car is that of renewing old, worn and torn linoleum on the running boards. Black ribbed rubber or gray linoleum are usually selected for bright colored cars, but you can make your own choice of a color that will harmonize. The small screw bolts around the edge are loosened and the outside edge strip is removed. Where this is riveted, the light rivets can be cut off with a sharp chisel. Use a sharp putty knife to clear off the old linoleum and with the edge of the knife clean the running board surface entirely smooth. Cut the new covers to exact size and do not allow any surplus which would cause bulging. Sodium silicate and water (water glass) may serve as a cement. Apply this to both the linoleum and the running board. Place any available weights or boards on the new covers until dry.

Tighten up all screws and use small screws in place of the rivets which were cut out. The job is then complete. You will be surprised at how well your car looks.

A Home-Made Self-Bailer for Racing Hydroplanes

By John Milton

THESE bailers are inserted in the inside ends of the two brass pipes placed through the transom. They are watertight when the boat is not in motion and as soon as you are under way, they can be pulled out and the suction created by the water rushing past the transom will pull all the water out of your boat at an incredible speed! Either one will suffice under ordinary conditions, but should you ship a large wave and have your boat fill half way to the gunwale, don't worry, pull both plugs and in three minutes time, your boat will be bone dry, and it will remain dry as long as you are running. However—DON'T FAIL TO REPLACE THE BAILERS AS SOON AS YOUR BOAT LOSES HEADWAY OR YOU WILL SINK IN NO TIME! That is why these bailers should only be used in racing hydroplanes, as the tendency to forget is less natural in a racing boat where one is ever on the alert.

Materials Needed

Two ½ inch brass or copper screw eyes.

One solid (red because it's softer) rubber ball 2 inches in diameter.

Two 2 inches by ¼ inch brass ring bolts with round heads.

2 washers for same.

2 pieces of 3/16 inch brass pipe 2 inches long by 2 inches OUTSIDE diameter.

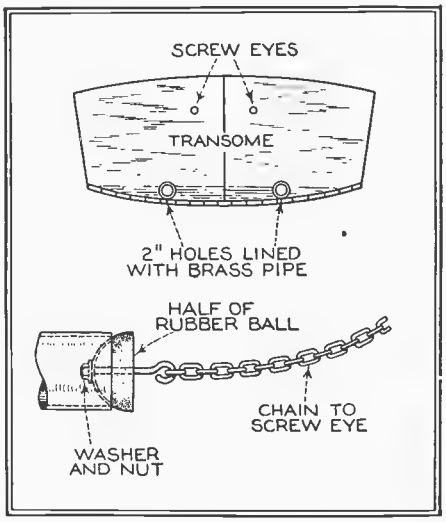
Two 18 inch lengths of ordinary bathroom chain.

Cut the ball in half. Insert a bolt in each half with the rounded side of the ball away from the ring on the bolt, placing washers on rounded side under the bolt head. Fasten the chain in the ring on each bolt.

Place screw eyes 18 inches apart, six inches from the top of, and equally spaced on either side of a line running from top to bottom directly in the center of the transom. Fasten the other end of the chains to the screw eyes.

Bore two 2 inch holes (not a fraction more), ¼ inch off the bottom and 12 inches on each side of the center line running from top to bottom of the transom.

Insert the brass pipe in the holes so that there is no space between wood and metal where the water can leak through.



The construction of this bailer is simple.

Now insert half the rubber ball with the screw eye inside the boat attached to the chain, which in turn is attached to the transom, and your bailer is ready.

As soon as your boat is planing, pull either chain, or both if there is much water in the hull, and you will have a bone dry craft as long as you are running. WHEN YOU STOP—REPLACE THE PLUGS!

$5,000 FOR PERPETUAL MOTION

The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore, the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

STRONG AND LITHE AS A PANTHER

You'll never see an Old Town sag at the stern because the motor's too heavy. These boats don't get that way! Stern, keel, and ribs are reinforced for extra rigidity. Old Towns don't shiver, shake, or vibrate, either. And the heavy, non-leak canvas-covering is *seamless*. Caulking never needed. Swift, light, well balanced, easy to handle, and built to do heavy duty.

Free catalog shows all craft. Paddling, sailing, and square-stern canoes. Outboard motor-boats, including big, fast, seaworthy, all-wood family-boats; rowboats; dinghies; and speedy step-planes. Write today. Old Town Canoe Co., 1246 Main Street, Old Town, Maine.

"Old Town Boats"

BE AN AIR MAIL PILOT ...EARN $550.00 a month

LEARN AT LINCOLN Where "LINDY" Learned

Take advantage of the world's greatest opportunity! Last year air mail and transport pilots were paid an average of $550 per month. Other pilots also made big money.

Lincoln Graduates Get Best Jobs because operators know they receive highest type of flying training. Seasoned, government-licensed instructors. 4 types of training planes. $250,000 worth of buildings and equipment. $100,000 airport. *Both Flying and Ground School Government Approved.*

Lincoln Mechanic Graduates also preferred because we teach factory methods. Airplane factory connected with school. Also Radio, Welding, Home Study Aviation Courses.

We assist students to find part time employment to help defray living expenses while in training. Write for details, stating age. **Lincoln Airplane & Flying School, 220 Aircraft Building, Lincoln, Neb.**

AN EASY WAY TO SHAPE your NOSE

Anita Nose Adjuster shapes flesh and cartilage—quickly, safely, painlessly, while you sleep or work. Lasting results. Doctors praise it. Gold Medal Winner. 87,000 users. Write for *FREE BOOKLET.*

30 DAYS HOME TRIAL

ANITA INSTITUTE, F-73, Anita Bldg., Newark, N. J.

No Wind Can Blow It Out

SOMETHING DIFFERENT
Mystery Cigar Lighter
MAKE BIG MONEY

Showing this scientific marvel to men. New principle of ignition. What makes it light? No flint or friction. All guaranteed. Sample with sales plan 25c. Sample gold, silver or chromium plated, $1.00. Agents, write for proposition.

NEW METHOD MFG. CO.
Desk S1-6, New Method Bldg., Bradford, Pa.

Moulds as low as $1.50 each.

Cast Your Own Lead Soldiers, Indians, Hunters, Wild and Farm Animals

235 Wonderful "True to Life" Models. Easy and inexpensive to make. I furnish all necessary material including enamel. Send 5c Stamp for Illustrated Catalogue A.
H. C. Schiercke, Ghent, N. Y.

A CLIPPER SHIP $4.50

The Famous Flying Cloud with electric lights

We supply all the parts, cut and numbered, ready to put together. Instructions show full details how easily each one of the numbered parts fits into the other. A few hours of pleasant pastime and you will have a beautiful and valuable model. Our other popular models are: Santa Maria, La Pinta, Mayflower, at $4.50 each. Constitution (O'd Ironsides), $5.98.

OUR LATEST CREATION: Spanish Galleon, fully equipped with electrical illumination, $6.98.

COACH MODELS, $4.98

We have parts for the following coaches: George Washington, Princeton to Philadelphia, Tally-Ho; Deadwood, Overland, Western, at $4.98 each. All models sent C. O. D. Foreign orders must be accompanied by U. S. check or money order.

Our new illustrated catalog sent FREE on request.

C. J. BIERBOWER,

3216 Baring Street Dept. SI. Philadelphia, Pa.

Originator of Build-your-own-ship-model

$--ALWAYS HAVE LUCK!--$

Unlucky in Money, Games, Love or Business? You should carry a pair of genuine MYSTIC BRAHMA RED LIVE HIGHLY MAGNETIC LODESTONES. Rare, amazing, Compelling, Attractive, these LIVE LODESTONES are carried by Occult Oriental people as a POWERFUL LUCKY CHARM, one to prevent Bad Luck, Evil and Misfortune, and the other to attract much Good Luck, Love, Happiness and Prosperity. Special, only $1.97 for the two. With free full instructions. Pay postman $1.97 and 15c postage on delivery. Satisfaction or money refunded. You can be LUCKY! Order yours TODAY!

Dept. 98, P. S. BUREAU, General P. O. Box 72, BROOKLYN, N. Y

NOTICE! We absolutely GUARANTEE these genuine Mystic Brahma Lodestones are ALIVE! Just what you want, for they are the Real Thing—POWERFUL, HIGHLY MAGNETIC!

Learn Advertising at Home

Make money in advertising. Prepare quickly during spare time. Also earn while you learn. No experience necessary. New easy method. Nothing else like it. Send at once for free booklet—"Win Success in Advertising", and full particulars. No obligation.

Page-Davis School of Advertising
3601 Michigan Ave., Dept. 142A, Chicago, U. S. A.

In June RADIO NEWS

Lt. Wenstrom follows up his interesting proposal made in the April issue of a system of long wave super power broadcast stations to give national coverage. A more detailed study of some of the problems involved in this system are described in this issue.

Automobile radio comes in for its share of attention. In an article by Everett M. Walker, the various types of auto radio receivers now available and the methods of installation in vogue are detailed.

Dr. E. E. Free, a scientist of national reputation, tells how tone quality and characteristics of musical instruments, or in fact any sound, may be reproduced in visible form which permits precise analysis, in his article, "Writing Sound's Autograph." This is one of the numerous cathode ray tube applications described.

"How to Build a Practical Televisor" presents for the first time complete constructional data on a televisor which can be built at home and which is adaptable to reception and all types of television transmission employed in the numerous television broadcast stations now putting regular programs on the air.

Messrs. H. B. Stevens and M. J. Brown, Westinghouse engineers, in their article "Electric Eyes Keep Watch Over Industry," give an interesting picture of the numerous industrial applications of photoelectric tubes.

The details of the proposed Radio City are described by Samuel Kaufman in an article "Capital of the Radio World."

A nine-tube a.c. midget superheterodyne is presented by McMurdo Silver, a well-known radio manufacturer and writer, who is also a regular contributor to RADIO NEWS.

John F. Rider concludes his interesting article on "The History and Design of Broadcast Receiver Equipment" begun last month.

"Tapping the Short Waves," by Zeh Bouck, introduces the subject of short wave reception which brings new entertainment into the home and a new thrill to the hobbyist.

S. Gordon Taylor, technical editor, begins in this issue an article on the Scott 12-tube all wave superheterodyne receiver. The article not only describes the receiver in some detail, but tells about the long distance reception tests which the author conducted using this receiver.

In addition to the above feature articles there are a number of others and also some of the customary departments such as the Service Bench, Backstage in Broadcasting, Home Laboratory Experiments, Junior Radio Guild and What's New in Radio.

An Inside Cutting Chisel for Your Lathe

A Special Chisel to Make Inside Turning Easy

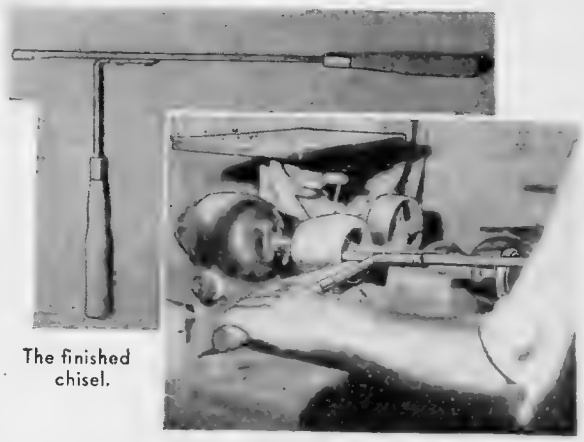
By John Horndale

WHAT usually happens when you start to make a lovely turned bowl or dish? The outside cutting progresses properly and everything goes as it should until you get at the inside cutting. Then, more often than not, you either stop the cutting about half as deep as this cut should go, or you continue the cutting and either blemish or ruin the job.

The trouble is, most lathe chisels are intended for outside work and while the cut-off chisel, being used on edge, is relatively free from vibration, there comes a point beyond which further cutting is hazardous.

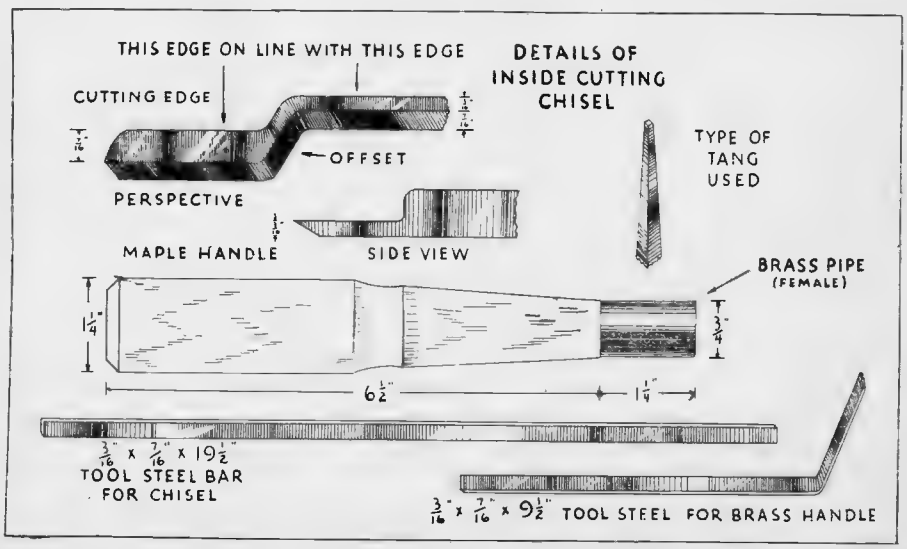
Not long ago this writer was completing an ash tray with turned box built integral with the upright at the top for cigarettes. The inside turning of the box was put off until the last thing. The first two inches of inside cutting progressed satisfactorily. From there on for another half inch, nothing happened. But at this point work was stopped while a special chisel was made to finish the cut. In theory it proved out at least, and when it had been made the cutting was continued down to the 3¼ inch depth desired. Since then many other inside cuts have been made with this chisel and you can accomplish far more with it than with any of the regular chisels. This is the way it was made.

Two lengths of 3/16 by 7/16 inch tool steel bar were procured. One was 19½ inches long, the other 9½ inches long. It later developed that these lengths could just as well have been reduced by at least 2 inches each. A nicely tapered tang was forged on one end of each bar. The other end of the long bar was sharply offset and shaped as shown with the right-hand and bottom edges in line. The short bar was bent at right angles as shown. Then on to the next step. The two



The finished chisel.

This is how the tool is used.



Note the simple construction of this unusually efficient tool that you can use on many jobs.

pieces were drilled and riveted together, the projecting left-hand piece extending to the left at right angles 5 inches from the cutting edge. Welding instead of riveting will be even better, except that there will be no way to change the piece later if this is desired. The cutting edge comes to a rather sharp point at the left to permit following the cut in smoothly. Practically no sanding is necessary on the inside wall.

The handles are of maple turned as shown. A piece of brass pipe ¾ inch in diameter is used for a ferrule. These were driven on and smoothed down in the lathe. They are of heavy pipe.

In use you hold the long chisel handle in the regular way in the right hand with the left holding the other handle. The cutting edge is fed into the work in the regular way and with good light inside the cut you can accurately keep the cutting edge just where you want it. Slight back-and-forth movements will prevent chattering and you can tip the chisel either way, sure in the knowledge that you have perfect control at all times.

For the Home Machinist

(*Continued from page* 151)

bar shown in Fig. 3 is excellent for many jobs. The bar is about 1½ to 2 inches in diameter bent and flattened at one end. This must be accurately done. A cross pin holds it horizontal. It is gripped by the vise and the extended end serves as a support and anvil for pipes and tubular work. One of these is a very handy addition to the vise.

When pipe tools are not available or the size of the cylindrical work exceeds the span of the wrenches, the method shown in Fig. 4 will prove of value to the machinist.

The grips for pipe shown in the lower view can be made from two small blocks of steel. The teeth can be roughed into the faces by machine or hand. A pin holds the blocks and a spring forces them open. The blocks are forced together by the jaws of the vise and the teeth will hold the pipe rigidly.

The upper view shows an improvised wrench for large pipes, cylinders and other work. To tighten or loosen these threaded parts either a steel cable or rope can be used with a turning bar. The cable is doubled and the bar is placed in the loop. The cable is wrapped several times around the cylinder. The leverage depends upon the length of the turning bar selected. This means can be used very frequently in assembly and disassembly work, and without damage to parts, such as occurs with a bar and sledge.

Many times it is difficult to measure bored holes. In recesses and in small cylinders, departure from the usual methods, such as shown by the illustrations in Fig. 5 is a means of saving time. The combined use of a pair of calipers and a micrometer results in accurate measurements of diameters. To use this method, it is necessary to file or grind spots on the calipers to take the micrometer readings from which to get measurements. The calipers are closed to remove them from the work and then opened again to the spacing of the micrometer. The distance between the ends of the legs obviously is the diameter of the bore. Similarly the measuring of depth of a small bored recess is difficult.

A quick and ready way is with a surface gauge inverted in the hole. The bent scriber point touches the surface to be measured and the length is determined when the surface gauge is removed. The means sketched will prove very satisfactory and rapid to use in work being bored or in measuring up old work. While there are special tools for use in making these measurements, the test of the skilled worker is that of adapting tools at hand, without delaying the work.

Scientific Book Reviews

THE DYNAMIC UNIVERSE, by James MacKaye. Published by Charles Scribner's Son. 308 Pages. Price $3.50.

Professor MacKaye in this book advances a tentative theory of the cosmos, which takes direct issue with the relativists: not with their mathematics but with their mysticism, subjectivity, metaphysics and unintelligibility.

Time and time again he refers to their "Mathematical" disguises of physical phenomena.

He is not, however, merely destructive, for by a process of very close reasoning he advances a theory of the universe based on radiation of a special kind and on the pressure of this radiation. It almost recalls the cosmic rays. He recognizes the observable phenomena made use of by the relativists —the increase of inertial mass with velocity, the contraction of a rod in longitudinal motion, and the deviation of light passing close to a massive body —beautifully fitting these phenomena into his theory. But he considers the changes of mass and length as real physical entities and not as mere effects relative to the observer or his "frame of reference." He discards "a space time continuum" and returns to an Ether not the elastic Ether of Maxwell, but a single and easily accepted Ether or radiation. By applying the well known laws of radiations, he can predict, as do the relativists, and explain as they cannot. The whole book is a lucid analysis

This Free Book shows how you can get into AVIATION

Walter Hinton
First to pilot a plane across the Atlantic, first to fly from North to South America, first to use the plane in exploration. Get his Free Book.

HERE'S the book that tells just where your chances are in Aviation today. It gives answers to the questions: "What does Aviation offer me?"—"What must I do to get into Aviation?"—"What job can I hold?" It explains how Lieutenant Walter Hinton, through a remarkable personalized home-study course can give you—RIGHT AT HOME—the groundwork employers demand. Hinton also backs you up with an active employment service when you are ready for a job.

Send the coupon today.

Get into Aviation

Walter Hinton, President 604-A
Aviation Institute of U. S. A., Inc.
1115 Connecticut Ave., Washington, D. C.

Please send me your Free Book showing how I can train right at home for a place in Aviation.

Name.....Age.....
(must be 16)
Address.....
City.....State.....

IT'S EASY to learn to play

THE BOY who can *play* lives in a world of *popularity, enjoyment, success.* And it's easy to learn to play. Three Sax' lessons, *given* on request, start you right off. Buescher's easy blowing, easy fingering, beautiful tone *assure rapid progress.* Make spare time money. Get what you *want.* Ask your Buescher dealer for any instrument on *six days' free trial.* Or write direct for beautiful catalog. *Easy terms.*

BUESCHER BAND INSTRUMENT CO.
612 Buescher Blk. B84, Elkhart, Ind.

A BUSINESS OPPORTUNITY!
Casting Metal Toys and Novelties

offers chance to earn real money. As our Manufacturer you make 5 & 10c Store Novelties, Toy Soldiers, Animals, Ashtrays, Auto Radiator Ornaments and other all year sellers. We help you sell the goods and also buy them from you. NO EXPERIENCE or special place needed and we furnish complete outfits. Small investment starts you in well-paying business and we help you build up. A big opportunity for the right man. Write at once for full information if you mean strictly business and want to handle wholesale orders now being placed.

Metal Cast Products Co., Dept. E
1696 Boston Road. New York City

MONEY MAKE UP TO **$25 A DAY** MONEY

Just out. Lights gas instantly without sparks or flame. Sells like wildfire wherever gas is used. Retails for 25c.

MYSTERY GAS LIGHTER

Packed on individual cards with instructions. Sample 10c or rush $9.00 per Gross or $1 per Dozen. New Method Mfg. Co., Desk SIG-6, New Method Bldg., Bradford, Pa.

POLISHED POINT AND RUBBER SPONGE with adjustable ink feed make this pen write better than any other. Money back if not pleased.

SAMPLE 39c FREE

Wholesale catalog, showing over 800 fast sellers. Write for your copy NOW. Spors Impt. Co., 331 Agate St., Le Sueur Center, Minn.

Makes Old Plugs Act Like NEW—Starts Car Instantly Without Choke.

New motor invention "HOT SHOT" increases power—speed. SAVES UP to 30% GAS—60% OIL. Delivers 11,000 volts. Transparent—shows BLUE spark if ignition o.k.—RED if faulty. Pays for itself immediately. $1.50 seller. Fits any car. Installed without tools. Gold mine for agents. "$25 a day easy", says Akeman. "Rush 500 HOT SHOTS", wired Klint. "Doubled my mileage," writes Beleke. "HOT SHOT a wonder", says Abbott. Car owners amazed. Agents cleaning up; part time, full time.

REARDON MFG CO.,
Dept. R.6, Peoria, Ill.

ACT QUICK WRITE FOR FREE SAMPLE OFFER.

Popularity
comes quickly when you learn to play a band instrument. For quick advancement and greater musical success start on an easy-playing Conn. The choice of Sousa and the world's greatest artists. Many exclusive improvements at no added cost!
FREE TRIAL, EASY PAYMENTS
Write for details and free book. Mention instrument. C. G. CONN, Ltd.
1656 Conn Building Elkhart, Indiana
FREE TRIAL

MODEL BLUEPRINTS

Correct—Easy to Follow

1-2	Horizontal Steam Engine details..set	$1.00
3-4	Boiler construction for above....set	1.00
5	880-Ton Bark	.50
6-7	Twin Cylinder Steam Engine and Boiler .....set	1.00
8-9	Gasoline Fired Locomotive.....set	2.00
10-11	U. S. S. Constitution, "Old Ironsides" .....set	1.00
12	13th Century Man-of-War	.50
13-14	Chinese Junk .....set	.50
15-16	Electrically Driven Automobile..set	1.00
17	Roman Ballista	.50
18-19	Simple Steam Engine .....set	.50
20-21	How to Build a Reflecting Telescope.	1.00
22	"Santa Maria," complete.....	.50
23-24	Model U. S. S. Portsmouth.....set	$1.00
25	Building a Model Tugboat.....	.50
26	Twin Cylinder Marine Engine.....	.50
27-31	U. S. S. Truxton.....	2.00
32	Sopwith Biplane	.50
33	Speed Boat	.50
34	Airplane Engine	.50
35-36	Motor Winch	.75
37-38	Vertical Steam Engine.....	1.00
39	Cannon	.50
40	Steam Roller	.50
41	Prairie Schooner	.50
	Lincoln Sport Biplane (man-carrying)	6.75
	Gerber Monoplane (man-carrying)..	1.00

Anyone who can read blueprints and is at all handy with tools, will find no difficulty in following the simple explanatory diagrams. Many sport planes and monoplanes built from our plans are flying daily, thus attesting to the accuracy of the blueprint details. Satisfaction guaranteed.

Send Orders to

Science and Invention
Blueprint Department
381 FOURTH AVENUE
NEW YORK CITY

of the questions involved, and its very simplicity of treatment gives a strong sense of its probability, and a feeling of relief at being emancipated from the painful anesthesia of the relativists of whom he says, "Their conclusions are based on the behavior of equations rather than on the behavior of nature."

FOUR CENTS AN ACRE, by Georges Oudard, Published by Brewer & Warren, New York. 316 pages. Price $3.50.

As we sit in comfort and leisurely review the history of a nation, dominion or state, it seems to unfold itself very simply and logically. Events follow one another, inexorably; fate seems to rule; nowhere can we find an instance in which human consciousness, will and striving, have had any apparent effect upon the steady march of destiny. Instead of curbing the tide of events individuals appear to be mere chips floating down the stream. We are apt to feel that any review of accomplishments can only be dull even though informative.

How different when we read a work like Oudard's, which despite its untext-book-like title, is a history of Louisiana from its discovery till the acquisition of the province by the United States. Here we have a stirring tale in which move real, romantic, characters. We see flesh and blood people actuated by motives which we can understand and appreciate. Men and women struggle through jealousies and political intrigues, fight the elements and wage war, just as we do today. The technique of human endeavor remains the same, only the application of effort has been changed by modern developments.

Throughout the tale we are forced to recognize that it was not the desire for exploration, as an end in itself, that drove these hardy pioneers ever onward. No. Intense rivalry between different religious orders, the Jesuits, Recollects, and Sulpicians, spurred their devotees on to greater effort for the aggrandizement of the order. Often distrust of the priests by the civil authorities prompted the latter to play one order against the other. Sometimes these petty, political bickerings prevented the setting out of an expedition or hampered the execution of a campaign that might have had far reaching results.

Back of all this we can sense the inability of the French to maintain a successful policy of colonization. Stingy Versaille allowed the clergy in her American possessions to assume more and more the duties of exploration, defense and government. As the church bore the expense, the mother country felt that she was effecting a great saving. But at what price! The home government planned only for these profits which it saw directly before its face. A far-sighted plan that would realize future earnings was beyond the comprehension of these astute politicians. Ready cash was their only standard, for ready cash Louisiana passed out of their control, for four cents an acre.

THE SCIENCE OF LIFE, by H. G. Wells, Julian Huxley and G. P. Wells. Published by Doubleday, Doran & Co., New York City. Two volumes, 1,564 pages. Price $10.00.

The authors of "The Science of Life" were well fitted for the task both by training and experience. H. G. Wells produced *The Outline of History*, to which this is a companion work. Julian Huxley is one of the leading biologists of the day and the grandson of H. G. Wells' teacher, Prof. T. H. Huxley. G. P. Wells, the son of H. G. Wells, is a research worker at University College, Canibridge.

As in *The Outline of History*, an attempt was made to bring to the average reader a mass of facts. However, this material is presented not as individual, unrelated matter but a tie-up is maintained so that the proper perspective is attained and the whole is not swallowed by the part.

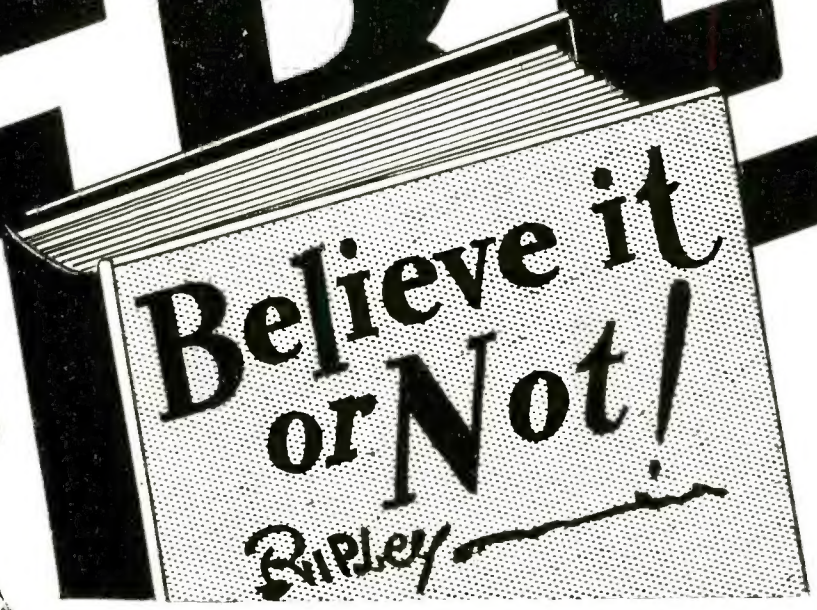
In brief: Volume one opens with a discussion of what constitutes life. This is followed by a functional description of the human body. The life processes and development, in every sense of the word, of plants and animals are next treated. (Evolution is not regarded as a theory but as an incontrovertible fact.) The biology of the human race is the last topic to receive consideration.

Although an expository work, the style of writing is such as to make pleasant reading. The text will not overtax Mr. Everyman for whom the book was specially prepared.

We feel that the three authors sounded the keynote when the statement was made that much scientific knowledge is not available to the general reading public, or is too technical for ordinary consumption, or is still the subject of controversy, or is contrary to the doctrines of certain religions, and then go on to say . . . "In the care of his health and the conduct of his life the ordinary man, therefore, draws far less upon the resources of science than he might do. He is unavoidably ignorant of much that is established and reasonably suspicious of much that he hears. He seems to need the same clearing up and simplifying of life that *The Outline of History* and its associates and successors have given to the story of the past. And the present work is an attempt to meet that need, to describe life, of which the reader is a part, to tell what is surely known about it, and discuss what is suggested about it, and to draw as much practical wisdom as possible from the account."

Reviewed books can be obtained from the Publishers or through Our Book Department

FREE



with this new Special Offer

from SCIENCE AND INVENTION

The Upside-Down Man who hangs head downward for three hours at a time; and the Horned Kaffir of Africa!

HERE are a myriad of wonder tales set down in cold print by Robert L. Ripley, the famous, amazing traveler who has traversed sixty-nine countries in search of the almost unbelievable material now incorporated within the covers of this book. *HE CAN PROVE EVERY STATEMENT HE MAKES!*

In this sensational book he tells his incredible stories of man-eating clams, the barking bird, oysters that catch mice; he describes the whistling trees and fountain of blood; he talks with you about the Ever-Standing Men and the Upside-Down Men of Benares; he introduces you to a woman who has sixty-three husbands, one who had sixty-nine children, and a wholesale father who was the proud possessor of 548 sons and 340 daughters! You will find your old favorites, and some new puzzlers which Mr. Ripley has uncorked for the first time. *BELIEVE IT OR NOT!*—this volume contains a thousand new things under the sun!

Acclaimed by Critics All Over the Country!

Newspapers and reviews from coast to coast have only unlimited praise for Ripley and his book. The New York *Sun* says: "BELIEVE IT OR NOT! is a book extremely difficult to put aside. It is one of the most fascinating volumes we have seen in months—a book full of strange, weird and unbelievable facts, accompanied by excellent drawings by the author." From San Francisco another reviewer says: "When a reviewer gives the 16th hour of a 16-hour working day to reading BELIEVE IT OR NOT! and when he stays up an extra hour to finish it, you know it must be fascinating."

And now this book, for which many hundreds of thousands of people have gladly paid a substantial price comes to you absolutely FREE OF CHARGE with a special 15 months' subscription for SCIENCE AND INVENTION!

With a Cash Saving on Your Subscription!

SCIENCE AND INVENTION, the one magazine which brings you all the new, amazing, thrilling, startling scientific news from the four corners of the earth—offers you Ripley's BELIEVE IT OR NOT! book with a 15 months' subscription for only $3.00. 75c less than you would pay for the same number of single copies! AND YOU DO NOT NEED TO SEND THE ENTIRE AMOUNT NOW! Simply send $1.00 with the coupon below, as your first payment—and pay the additional $2.00 to the postman when he delivers the gift book to your door! We prepay *all* postage and C. O. D. expenses. But don't delay—our stock of these books is limited, and to take advantage of this offer you will want to sign the coupon immediately!

Mail Coupon TODAY!

SCIENCE AND INVENTION, Dept. 2506-A
381 Fourth Avenue, New York, N. Y.

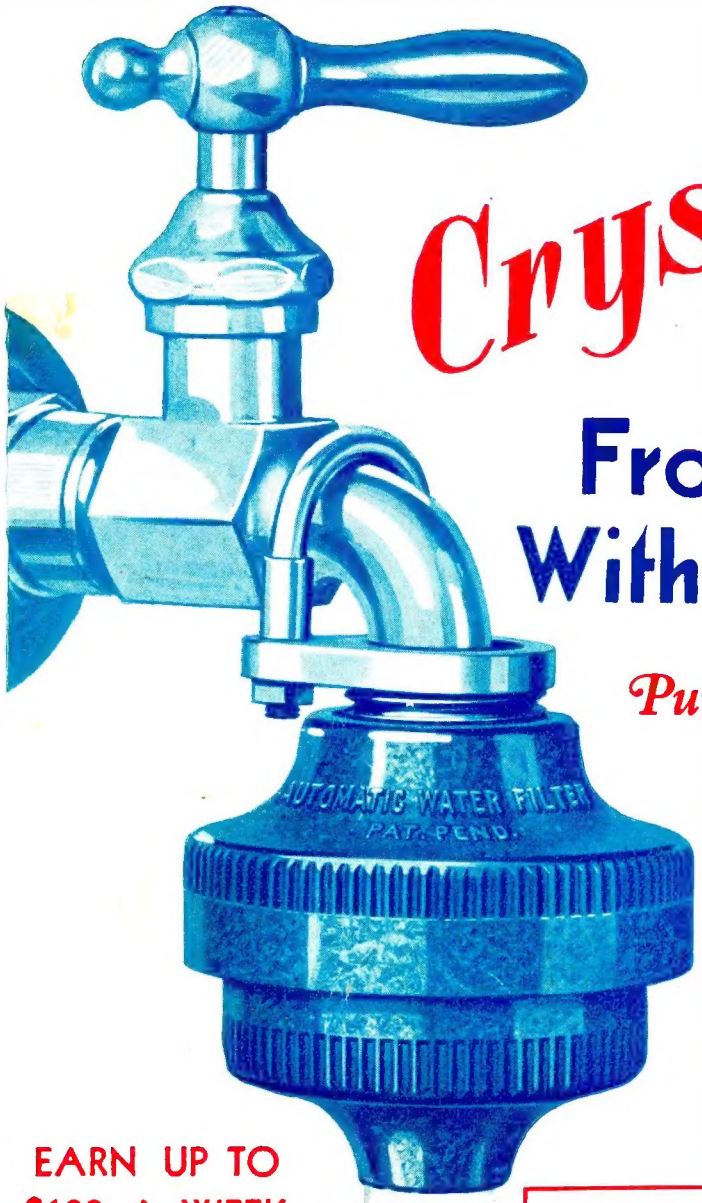
Please send me immediately Ripley's book, "BELIEVE IT OR NOT!" and enter my subscription for 15 months of SCIENCE AND INVENTION for $3.00. I am enclosing $1.00 with this order, and will pay the postman only $2.00 when the book is delivered at my door. You pay all postage and C. O. D. expenses.

Name .....

Address .....

City and State .....

Crystal Clear WATER From Your Faucet With New Invention



Purifies Water - Removes Dirt

JUST imagine a device that purifies water instantly at the faucet. In just 10 minutes it removes enough dirt and filth to fill the bottom of a glass.

Attached to the faucet in an instant, it delivers pure sparkling water, clear as crystal, and free of all dirt and germ laden filth.

It's just like bringing a bubbling crystal spring right into your kitchen. The Automatic Water Filter works like Nature in passing water thru crystal silica sand. This delivers a sparkling pure stream of water, free of impurities, pleasing to the taste, and healthful to the body. Crystal spring water could be no more pure or healthful than water coming out of the Automatic Filter.

Prevents Sickness and Disease

Housewives everywhere want the filter as protection against sickness and disease. Scientists have proven that water filtration prevents such diseases as Typhoid Fever, Erysipelas and Puerperal Fever, and actually lowers the death rate from Typhoid Fever. Is it any wonder folks are protecting themselves with this marvelous and inexpensive device, that means so much to health and happiness.

EARN UP TO $100 A WEEK

We have arranged a plan that makes it possible for agents to start immediately, making big money with the Automatic Filter. Good paying territory is still open. The agency for the Automatic Filter is a gold mine. Right in your territory there are thousands of prospects just waiting for this safe, sure, and inexpensive way to purify their health. Here is an absolute necessity and a real health protector. Everybody drinks water—everybody is a prospect. The Filter sells itself, and every demonstration means a sale

AGENTS!

If you are earning less than $3.00 an hour, clip and mail the coupon today. Quick sales, big profits, and a product everyone has been looking for, gives you immediate success and a steady business. For interested workers we have arranged so their sample will cost them nothing. Mail coupon today for FREE OFFER PLAN.

GUARANTEE

It makes no difference where you live, or what kind of drinking water you have, the Automatic Water Filter will remove dirt and filth from it. We guarantee it to purify water, remove dirt and filth, protect against contamination, and deliver pure, crystal clear sparkling water, or the trial costs you nothing. Try the Automatic Filter in your own home at our risk, and prove it to yourself.

SEND THIS COUPON TODAY

Automatic Water Filter Co.
Dept. 1226, 2621 N. 3rd St., Milwaukee, Wis.

Gentlemen: You may send me full particulars of your free offer and big money-making proposition.

Name .....

Address .....

City .....

AUTOMATIC WATER FILTER CO.

2621 N. THIRD ST. MILWAUKEE, WIS.